DOCUMENT RESUME

ED 236 787 EA 016 173

AUTHOR Hawkey, Earl W.; Kleinpeter, Joseph
TITLE Computerized Management of Physical Plant Services.
INSTITUTION Association of Physical Plant Administrators of Universities and Colleges, Washington, D.C.
REPORT NO ISBN-0-913359-00-9
PUB DATE 83
NOTE 187p.
PUB TYPE Guides - Non-Classroom Use (055) -- Reports - Descriptive (141)

EDRS PRICE MF01 Plus Postage. PC Not Available from EDRS.
DESCRIPTORS *Administration; *Computer Programs; *Computers; *Educational Facilities; Equipment Maintenance; Facility Inventory; Fire Protection; Guides; Higher Education; Input Output Devices; *Microcomputers; Recordkeeping; *School Maintenance; Service Vehicles; Time Sharing

ABSTRACT

Outlining the major areas to be considered when deciding whether or not to computerize physical plant services in higher education institutions, the author points out the shortcomings of manual record keeping systems. He gives five factors to consider when deciding to computerize: (1) time and money, (2) extent of operation, (3) current and future workload, (4) institutional policy, and (5) the pros and cons involved. In part 1 the options for the physical plant manager to consider in computerizing are presented: the overall system design, the basic hardware decisions, the types of input and retrieval systems, and the software options. The author gives detailed explanations of hardware options and software design (and documentation) to be considered during the decision-making process. In part 2 a modular approach to implementation of sample programs is presented for six specific services of the physical plant department: facility maintenance, groundskeeping, housekeeping, fire safety, vehicle maintenance, and stores inventory. Appendixes list nearly 400 higher education physical plants that are computerized and offer a glossary of technical terms. (MD)

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# COMPUTERIZED MANAGEMENT OF PHYSICAL PLANT SERVICES

by Earl W. Hawkey and Joseph Kleinpeter

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EA 016 173

published by
the Association of Physical Plant Administrators
of Universities and Colleges

**Published by**
**the Association of Physical Plant Administrators**
**of Universities and Colleges**
**Eleven Dupont Circle, Suite 250**
**Washington, D.C. 20036**

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ISBN: 0-913359-00-9

Library of Congress Number 83-072100

Printed in the United States of America.

Edited by: Steve Howard
Design and typesetting: Scott Photographics, Inc.
Printing: Automated Graphic Systems

# Table of Contents


List of Illustrations vii
Acknowledgments ix
Introduction xi

Part I Computerized Management: An Overview

CHAPTER 1 **The Decision to Automate Physical Plant Services** 1

- Shortcomings of Manual Record Keeping Systems 2
  - The Paper Chase 2
  - Cost Control 2
  - Project Scheduling 3
  - Maintenance Histories 3
- Solutions Through Automation 4
- Reasons For a Lack of Automated Facilities Operations 4
- Five Factors to Weigh in Deciding to Computerize 5
  - Time and Money 5
  - Extent of Operation 6
  - Current and Future Workload 6
  - Institutional Policy 6
  - Pros and Cons 6

CHAPTER 2 **Automation Options for the Manager** 7

- Overall System Design 7
- Basic Hardware Decisions 8
  - Use of the Campus Mainframe 8
  - The Dedicated System 8
- Types of Input and Retrieval Systems 9
  - Batch 9
  - Interactive 9
  - Hybrids 10
- Software Development Options 10
  - Standardized Software 10
  - Custom Software 11
  - Software Development Group 11
  - In-House Design 12

**CHAPTER 3** **Hardware Options** 13

- Central Processing Units 13
- Input/Output Devices 14
  - Terminals 14
  - Printers 15
- Auxiliary Storage Devices 16
  - Cards and Magnetic Tapes 16
  - Magnetic Disks 16
- Reliability, Service, and Total Costs 17

**CHAPTER 4** **Software Design and Documentation** 19

- Software Design 19
  - Modular Design 19
  - Four Characteristics 19
- Programming Languages 20
  - For the Mainframe 20
  - For the Mini or Micro 20
- System Analysis 21
- Documentation 21
  - Data Elements 21
  - Input Procedures 22
  - Output Procedures 22
  - Sequence of Operation 22
  - Diagnostic Aids 22
  - Operator Training Manual 23
  - Programmer's Guide 23

# Part II A Modular Approach to Implementation of Sample Programs

**CHAPTER 5** **Facility Maintenance** 27

- Facility Maintenance Menu 27
  - Selection 01 — Maintenance Dispatch 27
  - Selection 02 — Work Order System 29
    - Work Order Entry 29
    - Work Order Backlog 29
    - Work Order History 30
  - Selection 03 — Equipment Master 30
    - Equipment Inquiry 30
    - Equipment Numbering System 31
    - Bill of Materials Inquiry 31
    - Equipment History 33
    - Utilizing the Equipment Master System to Replace Equipment Parts 34
  - Selection 04 — Preventive Maintenance Master 34
    - Preventive Maintenance Library 34
    - P.M. Card Format 34
    - Establishing Frequencies of Preventive Maintenance 35
    - Preventive Maintenance/Equipment Inquiry File 36
    - Preventive Maintenance Sequence 36
  - Selection 05 — Maintenance Forecast 37
    - Tolerance Planning 38
  - Selection 06 — Deferred Maintenance 38
    - Deferred Maintenance 38
    - Capital Lifecycle Replacement 39

CHAPTER 6 **Groundskeeping Service** 41

■ Groundskeeping Menu 41
Selection 01 — Zonal Turf Management Program 41
Task Master File 42
Task Forecast 42
Selection 02 — Equipment Master 42
Bill of Materials Inquiry 43
Equipment History 43
Selection 03 — Equipment Preventive Maintenance Master 44
Selection 04 — Work Order 44

CHAPTER 7 **Housekeeping Service** 45

■ Housekeeping Service Menu 45
Selection 01 — Building Master 45
Selection 02 — Task Library 46
Selection 03 — Workloading Matrix 47

CHAPTER 8 **Fire Safety Inspection Service** 49

■ Fire Safety Master Menu 49
Selection 01 — Fire Stations 49
Station Inventory 49
Service/Station Master 49
Print Station Services 50
Selection 02 — Fire Safety Inspections 50
Inspection Master File 50
Print Fire Safety Inspections 51
Selection 03 — Fire Safety Citations 51
Outstanding Citations 52

CHAPTER 9 **Vehicle Maintenance Service** 53

■ Vehicle Maintenance Menu 53
Selection 01 — Vehicle Inquiry 53
Selection 02 — Fuel/Oil Consumption 53
Selection 03 — Lifecycle Forecast 54
Selections 04, 05, & 06 — Preventive Maintenance Servicing 54

CHAPTER 10 **Stores Inventory** 57

■ Stores Inventory Menu 57
Selection 01 — Stores Inventory Master 57
Selection 02 — Order Processing 58
Stores Requisition 58
Where Used Inquiry 58
Min/Max Status 59
Shelf Life Status 59
Selection 03 — Utilization Analysis 59

APPENDIX A Computerized Functions at College and University Physical Plants 61

APPENDIX B Glossary of Technical Terms 117

About the Authors 125

# List of Illustrations


**Chapter 5: Facility Maintenance**

Illustration 1—Physical Plant Department Service Menu 27
Illustration 2—Facility Maintenance Menu 28
Illustration 3—Maintenance Dispatch System 28
Illustration 4—Work Order Flow Chart 28
Illustration 5—Work Order Backlog Report 29
Illustration 6—Work Order History 30
Illustration 7—Work Order History by Building 30
Illustration 8—Equipment Inquiry File 31
Illustration 9—Equipment Parts Listing by Equipment Manufacturer's Part Number 32
Illustration 10—Detailed Parts Inventory Data for a Motor 32
Illustration 11—Parts Replacement History 33
Illustration 12—Preventive Maintenance History 33
Illustration 13—Preventive Maintenance Schedule with Limited Instruction 35
Illustration 14—Preventive Maintenance Schedule with Detailed Instruction 35
Illustration 15—Preventive Maintenance/Equipment Inquiry Listing of Maintenance Schedules 36
Illustration 16—Preventive Maintenance Sequence 37
Illustration 17—Maintenance Forecast Report 37
Illustration 18—Maintenance Forecast Menu 38
Illustration 19—Deferred Maintenance Project Entry 39
Illustration 20—Lifecycle Project Entry 39
Illustration 21—Capital Renewal/Replacement Report 40

**Chapter 6: Groundskeeping Service**

Illustration 22—Zone Data File 41
Illustration 23—Groundskeeping Work Order 42
Illustration 24—Groundskeeping Task Forecast 42
Illustration 25—Equipment Inquiry 43
Illustration 26—Bill of Materials Inquiry 43
Illustration 27—Equipment History 44

**Chapter 7: Housekeeping Service**

Illustration 28—Field Data Survey Form 45
Illustration 29—Building Master File 46
Illustration 30—Area Cleaning Schedule 46
Illustration 31—Workloading Matrix Master 47
Illustration 32—Revising Frequency of Occurrence 47
Illustration 33—Workloading Inquiry 48

**Chapter 8: Fire Safety Inspection Service**

Illustration 34—Service/Station File 50
Illustration 35—Fire Station Service Card 50
Illustration 36—Inspection Master File 51
Illustration 37—Fire Safety Inspection Card 51
Illustration 38—Citation 52
Illustration 39—Citation Inquiry 52
Illustration 40—Outstanding Citation Report 52

**Chapter 9: Vehicle Maintenance Service**
Illustration 41 — Vehicle Information 53
Illustration 42 — Vehicle P.M. Library 54
Illustration 43 — Vehicle/P.M. Master 55
Illustration 44 — Vehicle Forecast Report 55
**Chapter 10: Stores Inventory**
Illustration 45 — Stores Inventory File 57
Illustration 46 — Stores Requisition 58
Illustration 47 — Where Used Inquiry 59
Illustration 48 — Min/Max Status 59
Illustration 49 — Utilization Analysis Menu 60

8

# Acknowledgments

The Association of Physical Plant Administrators of Universities and Colleges (APPA) gratefully acknowledges the contributions of the individuals who helped to make this publication a reality. Any deletions are purely unintentional.

Rex O. Dillow, APPA's vice president for professional affairs during the two years of development and production of this book, worked diligently and creatively to overcome the obstacles inherent with any major publishing venture. His leadership of the Professional Affairs Committee is commendable. The committee members are Donald Dedrick, University of Notre Dame; Russ A. Gonder, University of Western Ontario; R. E. Haubold, Texas Christian University; H. Stuart Litzsinger, Washington State University; Don M. Mott, Mississippi State University; and V. R. Turpin, University of Utah.

Barbara J. Fatkin coordinated the manuscript's initial review by a committee comprised of Charles C. Braswell, North Carolina State University; Emanuel Greber, ARA Maintenance Management Systems, Inc.; Richard S. Jacobs, Washington State University; James G. Krafft, The Ohio State University; James McNally, Crothall Systems, Inc.; Harley Schrader, University of Nebraska-Lincoln; and William W. Whitman, Iowa State University. Howard J. Cihak, Gallaudet College, deserves special mention for his valuable comments on the manuscript.

Teresa Burnau Evans conducted the survey and compiled the data that appears in Appendix A. A special thanks goes to Chuck Anderson at EG&G InterTech for generating the tables, and to Darshan Bigelson for doing the pasteup.

Maxine Mauldin typed many of the drafts of this book, and Peggy Brown proofread the galleys and page proofs. Finally, APPA acknowledges the advice and assistance of Lynn VanderVeer and Paul Zywusko in the production of *Computerized Management of Physical Plant Services*.

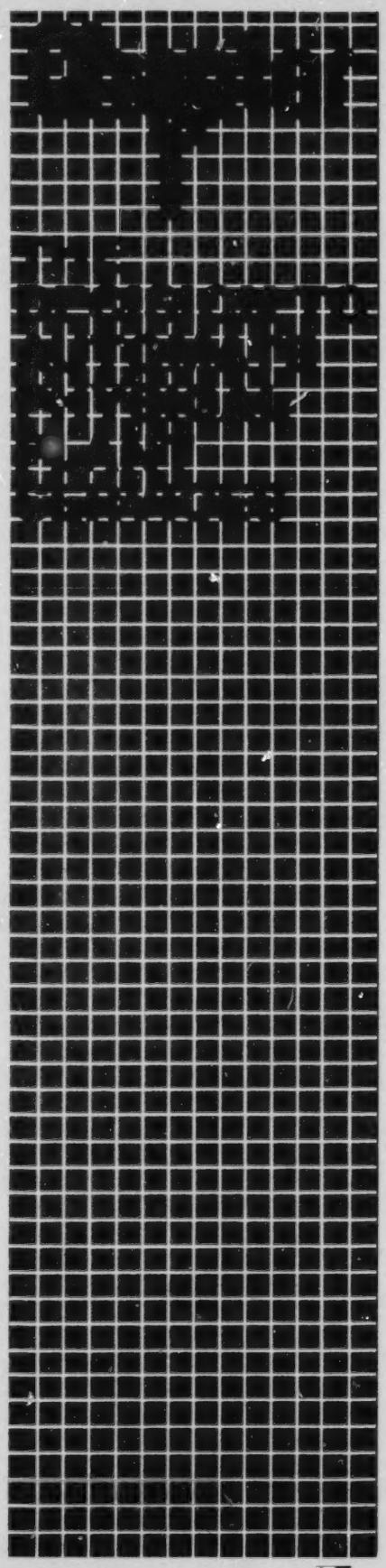
# Introduction

Written specifically for physical plant administrators in higher education, this book provides a practical discussion of the unlimited potential for computerizing physical plant services. Some of the possible applications are listed below and are not meant to be exhaustive; in fact, this listing barely scratches the surface. The number and range of applications at your college or university is limited only by your management needs and financial priorities.

- Work scheduling/work control
- Budgeting
- Interdepartmental billing
- Engineering services
- Groundskeeping
- Traffic control
- Telecommunications services
- Preventive maintenance
- Motor pool/vehicle maintenance
- Fire safety
- Payroll
- Stores inventory
- Utility services
- Building security/key control
- Cost estimating
- Time management
- Housekeeping
- Mail service

# Part 1

## COMPUTERIZED MANAGEMENT: AN OVERVIEW



Physical plant administrators today are faced with a number of difficult problems. Many of the buildings that were completed during the 1960s are aging rapidly. The life cycle for the mechanical systems in these buildings is nearing an end and their proper maintenance is becoming more difficult to handle efficiently. Add to this the fact that buildings and their support systems have become much more complex over the years. A building completed in the 1930s or 1940s required little continuous maintenance to keep mechanical systems operative, but such is not the case with modern structures. For these reasons a comprehensive preventive maintenance program is virtually required if major costs and downtime are to be avoided.

This situation has ramifications for good physical plant management. The most obvious of these is the need to have complete records on the types of mechanical equipment on campus—where it is located, the routine maintenance required for each item, and a schedule for performing the work. Less obvious is the pressure these requirements can put upon other areas for which the physical plant director is normally responsible. The increased number and variety of mechanical and electrical equipment requires either that numerous replacement spares be kept in inventory or that sources of supply can be quickly located if a part is needed. This usually requires something more than the good memory of a shop foreman or an index card system. In addition, the need to issue a long series of work orders for deferred maintenance work can be taxing to a non-automated work order system. If you are to maintain the fiscal and managerial control embodied in the very concept of a work order system, the process must be streamlined and made more efficient as the number of work orders issued expands your record keeping capacity.

With the increased complexity of building systems, the possible fire or life safety hazards also become difficult to monitor. This is made even harder by the many facets of new fire and life safety codes as well as the special hazards that have become part of the academic environment. Biological, chemical, and radiation hazards from sponsored research and other academic activities require an extensive, accurate, and easily retrieved base of information in the event of an emergency. Few physical plant administrators are prepared for such an eventuality.

Another challenge to the physical plant director is the need to manage and control these intricate building mechanical systems more efficiently. The high cost of energy and the rich opportunities for saving energy through centralized building automation systems cannot be ignored in today's environment. Such systems can range from fairly simple stand-alone units to extremely complex, multipurpose energy management/security/fire monitoring systems. While some savings can be obtained through more primitive conservation efforts, such as the use of timers and the manual shut-off of HVAC systems, only rarely can they match the speed, flexibility, and quality of modern central automation systems. Without such systems it is virtually impossible to optimize the operation of such items as a central steam or a chilled water loop.

Finally, modern management practices require greater reporting and data-gathering standards than are possible with most present physical plant management systems. The most preferable systems will collect data such as run time of motors; energy use of individual buildings; preventive maintenance scheduling; outstanding job orders; vehicle mileage and maintenance records;

fire alarm test time, date, and result; and many others. Younger institutional managers are usually experienced in the advantages of the extensive computerized management information systems that are becoming universal in financial accounting. Similar systems should be available to the director of physical plant as a tool for enhancing managerial efficiency. ■

## ■ Shortcomings of Manual Record Keeping Systems

### The Paper Chase

Given such an environment effectively it is becoming more difficult to manage a large physical plant without the assistance of some computer-based information and control systems. This is because manual systems for keeping track of financial, energy, and facility information suffer from serious shortcomings. The first of these, and the most obvious to experienced physical plant managers, is the total dependence on triplicate or even quadruplicate paper records arranged in different filing sequences. Even a minor work order issued through a physical plant office can generate a thick folder of invoices, time cards, spread sheets, and copies of the original order. And this excludes additional documents that may be placed into a building maintenance history file or any intermediate forms such as stores requisitions, purchase orders, and supervisor's job notes.

This "paper chase" can sometimes so mire down an operation that it significantly degrades the speed with which a request for service can be met. In some institutions nonemergency requests may require 30 to 60 days before a job can be estimated and scheduled, even when the materials are on hand. This is frustrating not only for the physical plant administrator but for the department or division requesting the service as well.

The overabundance of paper records also tends to increase the workload of the clerical staff in the physical plant department. In this era of dwindling resources the physical plant administrator more than ever wants to maximize his or her ability to complete the necessary projects in a timely manner. The inability of a clerical staff to keep up can cause a serious performance bottleneck. Any overwhelming increase in the clerical workload can also result in serious morale problems as the office staff falls further behind in its work through no fault of its own. All attempts to increase the field efficiency of the operation will be for nothing if the record keeping staff cannot keep up with the paperwork. One solution to this problem is to increase the number of office staff. Unfortunately, each new clerical position added also adds to general overhead costs with no real improvement in productivity.

A final difficulty inherent in physical plant operations that are totally dependent upon paper records is the need then to manage these records. All the paperwork generated by a physical plant operation has to go somewhere at the end of a project or fiscal year. Most plant offices tend either to keep these records forever or dispose of them relatively quickly after the end of a job. There are, of course, fallacies in both extremes. If retained too long, paper records begin to occupy and are usually haphazardly arranged. Depending upon the conditions under which they are stored, they may even constitute a fire hazard. On the other hand, if records are quickly destroyed the institution then loses all historical records of previous work performed. While this problem can be partially resolved without the use of electronic data processing equipment (through microfilming, for example), such solutions are usually less than optimal.

### Cost Control

Another shortcoming of a paper-based physical plant operation is that project or job information is rarely, if ever, current. Because paper takes time to circulate from desk to desk, budget and expenditure information is rarely kept up to date.

This is especially true in the example previously described in which office staff is unable to keep up with the current paper flow. This situation has serious results on the managerial function in the physical plant.

First, the lack of current information on a job results in a serious lack of fiscal control over a project. The physical plant administrator may know what the original cost estimate was, but he or she may not know whether the project is over or under budget at any particular time. This is a serious gap in the fiscal control managers must have over their area of responsibility. If a job is coming in over budget, the director must be able to see this so that he or she can take corrective action, or at least notify the person requesting the service of the situation. Projects coming in under budget may give the physical plant manager the opportunity to redirect freed resources to other problem areas.

A related problem inherent in this lack of firm fiscal control is the tendency for projects to experience serious cost overruns. The reason for this is that when no one is given information on expenditures versus budgeted amounts, there is no incentive to act in a fiscally conservative fashion. When the budget is clearly delineated and expenditures to date are known, there are usually fewer and less severe cost overruns.

The lack of current job information also usually results in the inefficient management of resources. It is common practice in most institutions for plant operating funds to be returned to the general account if not used during a given fiscal year. This is generally a significant incentive to spend all the allocated funds before the end of the fiscal year. When cost overruns and actual expenditures to date are unknown, it is difficult to properly manage the funds still available. This usually results in a flurry of mostly unplanned activity near the end of the fiscal year on projects that may or may not be the most important ones to accomplish. There is no reason for this to occur when current fiscal information is readily available to the physical plant administrator at all times. Resources freed from one area can be immediately applied to other projects in a planned, reasonable manner, thus avoiding a mad rush to expend all available resources before the end of the fiscal year.

## Project Scheduling

A further result of a paper-based physical plant management system is that, for the most part, paper records are not amenable for use in project scheduling. Instead, jobs are usually scheduled on a first-in first-out (FIFO) basis. Unless special care is taken, whole projects or portions thereof can be scheduled out of sequence in order to optimize job quality and the efficient use of personnel. Commuting time between job sites can be cut drastically if jobs are grouped according to location rather than on a FIFO basis. While supervisory personnel in smaller physical plant operations can usually accomplish the same goal manually, it becomes difficult and time consuming for larger operations with projects that require a great deal of cooperation between various shops to properly schedule the necessary work.

## Maintenance Histories

With a paper-based record system it becomes extremely difficult to get an historical perspective on past work performed. It is valuable to have a maintenance history on all major pieces of equipment and building systems so that a preventive maintenance program can be developed. In addition, such a maintenance history can be used quite successfully to make decisions on whether to repair or replace a piece of equipment. In a paper record environment it is usually too difficult or time consuming to keep up such maintenance histories. Soon the filing system becomes too unwieldly, and any thought of rearranging the information manually is quickly dismissed due to its time consuming and impractical nature. ■

## ■ Solutions Through Automation

Many of the problems inherent in a paper-based management system that have been outlined can be solved, or at least ameliorated, through the use of modern electronic data processing equipment. These aids can range from the simplest word processing systems to a dedicated mainframe computer. Most physical plant department needs fall somewhere between these two extremes, although few departments could really justify their own dedicated mainframes. Perhaps the most obvious advantage of computerizing a physical plant operation is the fact that computers are ideal for handling a large number of well-defined and repetitive tasks quickly. Human beings get bored and tired of tedious tasks such as adding long columns of numbers or typing several copies of the same information sorted in different ways. Computers perform such tasks uncomplainingly in a matter of seconds rather than hours or days.

Another major advantage in the computerizing of physical plant services is that it can completely eliminate the duplication of effort that is common in any function dealing with a large number of transactions. Once a certain piece of data is captured electronically, it can be sorted, rearranged, duplicated numerous times, and combined with other information in almost any possible way. For instance, rather than keeping duplicate files or making numerous carbons of a single form for filing purposes, the information can be entered once and the machine does the rest.

Because duplication is eliminated, clerical productivity can be increased significantly and the same number of people can process an even larger number of projects and/or transactions in a timely manner. Rather than updating project files on a weekly or monthly basis, information can be entered as it is received. Files are kept current because the electronic transfer of information is done in nanoseconds. As an additional benefit, information is usually more accurate than under a manual system where human error is common. Computers add, subtract, multiply, divide, and sort numbers efficiently and virtually error free.

Finally, information can be stored much more efficiently electronically than on paper. Just as huge volumes of paper can be stored in a relatively small space through microfilming, the same is true of electronic storage. By using this new technology, not only can you store extensive historical information almost indefinitely, but it is usually kept in a more usable and highly compact format. This eliminates many of the storage difficulties previously discussed. ■

## ■ Reasons For a Lack of Automated Facilities Operations

If the advantages of computerizing the management of a physical plant are so obvious, why are the use of such systems limited? The reasons are both structural and practical in nature. First, and perhaps most important, is the fact that many directors of physical plant are simply unfamiliar with the large-scale use of data processing equipment. Only in the last few years have hardware and software systems been developed which make it possible to computerize physical plant services without access to a large mainframe machine, itself supported by a large group of programmers and systems analysts. In such a situation computerization only made sense on large, complex campuses with extensive computer systems.

Another problem has been the large initial costs for purchasing the necessary hardware and software. While it is highly probable that significant productivity gains can result from the use of data processing equipment, such gains are hard to quantify accurately. When faced with a large initial expenditure, it is often difficult for the physical plant administrator to justify the purchase of such a system on the basis of tangible costs and savings alone.

The relative lack of well-written and documented software has also been a problem. Especially with the newer small computer systems, software must be designed specifically for a particular manufacturer's machine if it is to run efficiently. With the tremendous proliferation of hardware manufacturers, it has

been difficult for software houses to develop products for more than a handful of machines. This significantly reduces the potential market for their product, and the software itself increases in cost because the development costs cannot be spread among a large number of purchasers.

Often administrators and clerical personnel alike are resistant to any change in a manual system to which they have become accustomed. People are understandably apprehensive about changes from a pencil-and-paper-based system, which they understand well, to a computer-based system. They are usually completely unfamiliar with how a computer works and are afraid that they will do something wrong and break it. They may also be afraid that the machine will replace them in their jobs. In addition, the administrator may be apprehensive about the fact that his or her personnel will become too dependent upon the new machine. If it ever breaks down, the manager is concerned that the department will be helpless and unable to continue functioning smoothly.

Most of these fears at both the clerical and managerial levels are not really justified. Only rarely does the introduction of a computer system into an existing office situation cause the layoff of current personnel. Instead, the major cost savings from using such systems result in increased productivity and improved record keeping. Current employees have nothing to fear from automation. The hardware itself is devised to withstand punishment and abuse without damage, so employees should not worry about breaking something.

Management's fear of machine failure is perhaps a legitimate concern to weigh during any decision to computerize one's operation. While modern data processing equipment is extremely reliable, it will break down on occasion. But only rarely does this cause the complete shutdown of an operation. In fact, rarely is it more inconvenient than the absence of a key staff member for several days.

A final reason for the lack of computerized management systems in physical plant operations may be that many institutions believe they are simply too small to benefit greatly from the computerization of their management systems. While smaller institutions would benefit from the advantages of a computer system, the incremental gains may be fewer and harder to "sell" to their administration.■

## ■ Five Factors to Weigh in Deciding to Computerize

The decision to commit one's department to the computerization of physical plant services is not a simple one. There are, in fact, five major factors to consider before making a final determination.

### Time and Money

One of the most important elements to consider is the amount of resources available to the physical plant administrator. Not only will money be needed to implement such a system, but the time commitment required is also important. Computerizing one's operation is not simply a matter of going to a store and picking out a few pieces of hardware and a programming package or two.

At a minimum it will require administrators to evaluate their entire operational procedures, modify current procedures to conform with the requirements of the new system, train present personnel in the new procedures and the use of the equipment, and closely monitor the system immediately after implementation to ensure that it is working properly. Add to this the time that may be necessary to coordinate your activities with other institutional groups—department heads and the business officer, for example—that will need to know about your new systems.

Finally, the physical plant administrator must recognize that the life cycle for system hardware and software is approximately five years. Hence, the payback from the investment made in such a system should be something less than five years if the system is to be justified on a strict dollars and cents basis.

## Extent of Operation

The second factor to consider seriously is the size of your operation and the number of transactions that must be processed each year. It is obvious that a physical plant in excess of 1 million gross square feet would benefit from the computerization of its operation. In addition, if an office must process over 200 job orders during a typical year, it too would benefit from a computerized management system.

Such automation would also be justified in any significant research or hospital operation where detailed maintenance records are required by federal or state guidelines. However, a smaller plant that does not include complex mechanical systems, such as those found in research or health-care facilities, may not be able to justify implementing such a system. Each physical plant administrator must weigh in his or her own mind the possible advantages of computerizing their operations.

## Current and Future Workload

Another factor to contemplate is any current operational problem that you may be having in the physical plant area. If an operation is working smoothly without a computer-based system and all your management information needs are being met, it is probably not necessary for you to computerize. However, you should consider not only how well it operates currently, but also how well it would operate if your workload should escalate over the years. For instance, if you anticipate a major space expansion that could overburden your current systems, now may be the time to computerize rather than at a later time when you are already having serious problems.

An important point to keep in mind is that the automation of your operation will not, in and of itself, solve longstanding management or personnel problems unrelated to workload. A bad manual system will not suddenly become good just because it has been translated into a format that the computer can handle.

Similarly, personnel problems could be severely aggravated by the introduction of a computerized physical plant management system rather than solved by it. In order to implement physical plant automation successfully, the entire organization must work together and be fully committed to the same goals. For this reason it would be wise for a manager first to solve his or her department's structural problems before moving to computerize plant operations.

## Institutional Policy

A fourth aspect to consider is the institution's policy regarding the computerization of departmental operations. Many schools have established policies and standards for the development and implementation of management information systems. Such policies may call for all development to be done by a central computer group or contracted to a specific software house. In addition, certain equipment standards may further restrict your options. At the very least it is important that all significant institutional authorities be consulted before any decision is made regarding automation activities.

## Pros and Cons

Finally, the physical plant administrator must carefully and thoroughly consider the added capabilities that he or she hopes to obtain in the automation process. Do these capabilities constitute a mere "wish list" or will they add vital information necessary to the proper management of institutional resources? In addition to the advantages of computerizing, the administrator must understand the computer's limitations as well. The decision to computerize one's operations is a serious one that has many far-reaching consequences and will require a great deal of management commitment to complete. Computerization should not be entered into without devoting sufficient thought to the final goals of such a project. ■

# Chapter 2

# AUTOMATION OPTIONS FOR THE MANAGER

## ■ Overall System Design

Once the decision to computerize an operation is made, the physical plant administrator is then faced with basic decisions regarding system design, hardware configuration, and sources of software. As in all such decisions, compromises will have to be made between a comprehensive system that will automate virtually every segment of a physical plant operation, and smaller programs designed to accomplish certain narrow tasks. These two extremes will be referred to as the **comprehensive approach** and the **specific function approach.** ■

Normally, automation in the physical plant area occurs in a series of discrete, specific systems that are implemented at different times. There are certain advantages to such an approach. First, a carefully phased automation program implemented over a period of years is usually more efficient in terms of resources and less disruptive of day-to-day activities than a comprehensive "crash" program. It allows for a more orderly transition from a paper-based system to an electronic one. In addition, oversights or errors committed in the implementation of earlier phases of the program can be more quickly corrected and similar problems avoided in the later stages of the process.

The productivity gains versus the costs involved can be better gauged at each stage of the process, and a more rational decision can be made as to whether the next step is truly justified. Finally, for small- or medium-sized institutions it may not be practical to implement a comprehensive automated management system. By focusing on each operation, you can make a decision based upon the merits of automating specific tasks without being distracted by how this decision will affect other parts of your organization.

Admittedly, there are shortcomings in this approach to automating physical plant activities. The first and most obvious is the possibility of being saddled with a series of systems that bear no relationship to each other. There is even the possibility that each new system may require specific hardware that is not compatible with previous purchases. Such a situation should be avoided, if at all possible, since it is far more costly than when your software systems are able to share the same hardware. The only exception to this would be in the area of energy monitoring and control systems, as opposed to general office automation. Because such central monitor systems are specialized and require dedicated hardware to be most effective, consideration of such a system can usually be divorced from other aspects of physical plant automation. Yet, even here, it makes sense to combine energy management, central automation systems, and fire monitoring functions into one system, or at least allow for such expansion.

The disadvantages of a specific function approach to physical plant automation are the comprehensive approach's strong suit. You can avoid future costs by designing your systems in such a way that they can all operate on the same hardware. In addition, if the various information systems can be made to share data with each other, duplication of data entry and storage can be avoided. The comprehensive approach also allows for the integration of management information so that physical plant directors can get a better idea of what is happening in all phases of their operation rather than in one or two only. Finally,

the development of a comprehensive physical plant automation system forces the manager to look carefully at each part of the organization and how its services relate to the overall function of the institution. Such an exercise is good because it forces the director to take a broad look at an operation and can result in a reduction of functional redundancy.

A middle ground exists between the comprehensive and specific function approaches to service automation and could best be described as a modular approach to physical plant computerization. This is usually characterized by an initial, comprehensive study of the physical plant operation and investigates how the actions of one division affect the work of all others. This study would focus on the functions that could successfully be automated, and a general "master plan" would be drawn up for the entire department. However, rather than attempting to implement such a system in a single step, the project would be divided into a series of smaller "modules" that are also stand-alone software systems. The implementation of each module could then be justified and separately scheduled. Yet the possibility of utilizing unrelated software systems is also avoided since each part of the plan fits into a general, rationalized structure. In fact, many software vendors develop their general use systems in this way so that a customer need only purchase those modules that are needed at any specific time. ■

## ■ Basic Hardware Decisions

### Use of the Campus Mainframe

Once the physical plant director has made the decision to automate plant operations, he or she must choose the type of hardware on which the system will be based. This is not the kind of decision that can be made without consultation with other institutional administrators. Particularly, the physical plant administrator must bring representatives of the institution's data processing group into the decision making process.

Many institutions possess large mainframe computers that already perform such administrative tasks as student record keeping, registration, and accounting functions. If there is excess computer capacity still available in the campus mainframe, it makes sense to explore the possibility of tapping into this large computer system. Not only would this allow you to perform much more complex tasks in a computerized management program, it also opens up the possibility of linking your systems to other institutional systems. A prime example of such an integrated function would be tying the physical plant job order system directly to the accounting system. This would provide for a much simpler billing operation and would avoid the double entry of costing information.

### The Dedicated System

In other situations it may make more sense to go with a smaller computer system that would be totally dedicated to the specific needs of the physical plant department. This is likely to occur in a situation when the institution's mainframe computer is already saturated by its current workload and is incapable of adequately servicing the needs of another major user. Another time this route could be highly recommended is when the campus computer center is unable to provide the type of hardware and/or software support that you feel is necessary to properly implement the system you have in mind. Of course, if you are not bound to specific hardware, you should find the best software first and then buy the hardware to accommodate it. But even if you are bound to specific hardware, see if the software you want can be made to run on your campus hardware in a cost-effective manner.

The third reason for opting for a dedicated hardware system is if the memory capacity and programming capabilities do not require the level of sophistication provided by a mainframe machine. Since the cost of computer hardware is trending downward at the same time that the memory and analytical capability of mini- and

micro-computers is increasing dramatically, it is becoming more and more practical to purchase a dedicated computer system. A fourth reason for using a dedicated system is that emerging computer graphics for space planning and design almost require such systems. However, some of the smaller systems may not be capable of handling extensive graphics.

Just remember that if you decide to purchase a dedicated system, you will probably have to arrange for the maintenance and support of the system yourself. While service agreements are available from most hardware vendors, you will still have to operate the system and maintain the day-to-day operation yourself. ■

## ■ Types of Input and Retrieval Systems

While you are debating the merits of having a mainframe or mini/micro-based system, you should also decide the most appropriate method of inputting and retrieving information. Your decision in this area will be an important factor in the type of hardware system required for your operation. Among the items to consider here are whether an operation should have an on-line, interactive or batch-feeder system. The physical plant administrator will also have to decide on the need for multiple entry stations or a single work station from which information can be input and retrieved.

### Batch

Until the late 1970s most computer systems were designed to be batch operations. In this type of system transactions are collected together on a weekly or monthly basis. These grouped transactions are then processed at one time as a "batch" of updates. Perhaps the primary benefit of such a system is that it tends to be fairly inexpensive in terms of computer time because the updates can be run during non-primetime periods. However, there are also serious shortcomings to such a system.

First, batch systems are usually inadequate when a large number of transactions occur on a daily basis and current information is vital. This is because the batching requirements of such a system are oftentimes cumbersome. In addition, if an error is made in a particular batch, it cannot be corrected until the next batch of transactions is processed. If there is more than one error it may take several rounds of corrections before the problem can be resolved. In the meantime, the information at your disposal is incorrect and unreliable.

### Interactive

For these reasons, among others, current software products are evolving toward direct, on-line, interactive systems, or hybrids between traditional batch processing systems and interactive systems. This trend has been aided by the rapidly growing area of micro- and mini-computers, which are ideally suited to this type of software structure.

In a totally interactive system the user normally accesses information directly through a CRT (cathode ray terminal) display screen. Transactions or changes to the data are entered directly and are processed immediately. Hence, the information in your computer system is always current. As errors are recognized they can be immediately corrected rather than waiting weeks for the next updating cycle. Data entry is greatly simplified and there is less disincentive to keep the information current, as is the case with many batch systems.

The discussion thus far has not intended to imply that interactive systems are ideal for all situations. In fact, there are a number of drawbacks to such systems. First, they tend to be fairly expensive in terms of computer resources used since direct, interactive file updating is more complicated than batch updating. This is especially true if you are dealing with extremely large or complicated databases. For this reason such interactive systems are most commonly in use with mini- and micro-computers, which can be dedicated to one or a few limited functions.

A second problem with such systems is that sometimes the data is *too* easy to change or update. If access is not carefully controlled and the operator well-trained, erroneous or conflicting information can soon run rampant through a database.

### Hybrids

There are several ways around these problems. Two of the most popular techniques involve hybrids between batch and interactive systems that can be used fruitfully on a mainframe computer. In one such scheme the system transactions are not processed immediately, although it seems so to the operator since entries are made directly to a CRT. Instead, the system itself merely stores these transactions in a holding file for automatic processing at frequent intervals, usually daily. Because the frequency of updating is much greater than under older batch systems, the data is current to within 24 hours. This may be the most cost efficient way to update particularly large or complicated databases using mainframe computer systems.

A second technique that attempts to get around the possibility of entering erroneous data through operator error involves interactive screening of updated information. This technique uses software that searches for logical errors in a transaction. The file is still updated directly, but the computer's programming searches through the information as it is entered and will alert the operator to any possible errors. The errors can then be corrected immediately. Of all the various methods of data input and retrieval, this is perhaps the most sophisticated and complex. ■

## ■ Software Development Options

### Standardized Software

A final major choice that the physical plant administrator will have to make when deciding to computerize his or her physical plant operation involves the type of software that will be obtained. The two basic choices in this area are either to purchase a prewritten, generalized software package, or arrange for the writing of a customized software system to meet a department's specific needs and desires. You should recognize the advantages and disadvantages to either approach.

If you decide to purchase a prewritten software package, you gain the advantages inherent in spreading development costs among a group of purchasers rather than having to bear all the costs yourself. In addition, by buying a proven software package the physical plant administrator can significantly decrease the time necessary to implement the new system. One can usually gain from the experiences of others who have purchased the software and this improves the chances of an easy transition to a new, automated information system.

However, you must be extremely cautious in the area of purchasing standardized software. First, you should be certain that the package will adequately fulfill your needs not only now, but for at least the next five years. Second, be certain that the system you are purchasing is proven in the field and is actually in use at various sites under differing conditions. If at all possible contact other users to see if they are satisfied with the results. Third, make sure that the company marketing the software product will support or guarantee it if you experience difficulties with the system. You gain little by buying a software package if you cannot get it to work properly and the seller is unable or unwilling to correct the problem.

Fourth, make certain that you personally try out various aspects of the software by visiting an institution where the system is in operation. Possible problems often do not become apparent until you actually try some "hands-on" work. Fifth,

make sure that you carefully consider any special hardware requirements of the system you are considering. Some software packages can be used only on a certain manufacturer's equipment. If that hardware is not compatible with other applications you have in mind, it is probably not a wise move to commit yourself to it. Finally, if you are having difficulty evaluating the choices before you in this area, be sure to seek the guidance of experts at your campus computer center or an outside consultant.

## Custom Software

Your other basic alternative is to bear the cost of having software custom written to your institution or department's specifications. While usually significantly more expensive than purchasing prewritten software, this approach has a number of distinct advantages. First, by custom designing a system, the physical plant administrator can get exactly what he or she wants and does not have to accept the shortcomings of generalized programs. Second, some of the information systems that you want to use in your physical plant operation may not be readily available from software vendors. The only way in which you can obtain such functions is to have them custom written.

Third, you can usually better integrate the various customized programs so that they can share information and reduce duplication in data entry. Finally, through customized software you can provide for unique features that may be peculiar to your institution. For instance, if you wish to directly access your institution's financial accounting system, it will undoubtedly require custom software since canned packages, due to wide customer variances, rarely possess such provisions. A disadvantage and one of the chief problems with customized software is that someone familiar with computers has to write the program but often receives inadequate descriptions from someone who knows the physical plant operation. This process can mean years of "debugging" and is not recommended to anyone who is completely new to computers.

As noted before, the physical plant administrator should carefully evaluate the features of various generalized software packages before undertaking to custom design a unique system. However, do not purchase a predesigned software package if you anticipate the need to make major changes in its operation. Some customization is probably inevitable for large and complex software packages. If major, dramatic changes are needed, however, you would derive few of the benefits of a prewritten software system. In addition, the end product in such a situation is usually a serious compromise that still will not completely meet your needs. If you do not like any of the currently available packages then you should have your own custom software written.

Once you have made the decision to develop a custom system, you have two major options before you. First, you can solicit bids or proposals from software development houses either inside or outside of your institution. Second, you can hire your own programmer/analyst to develop the system that you want. There are obvious advantages to both courses of action.

## Software Development Group

If you decide to hire a software development house to fulfill your needs, you will have to do a great deal of preparatory work before you can solicit bids. You must decide what specific types of systems you are interested in purchasing, what specific information you want the system to contain, and the types of operations you need the system to perform. A document containing this information will serve as your generalized plan for the development of the system and will be further refined so that it can also serve as the system specifications. From the beginning you should solicit the aid of campus computer center representatives, because they can give you advice on how to develop proposals and prepare your bidding documents. They can also help

you refine your ideas and explain practical limitations on the computer's capabilities.

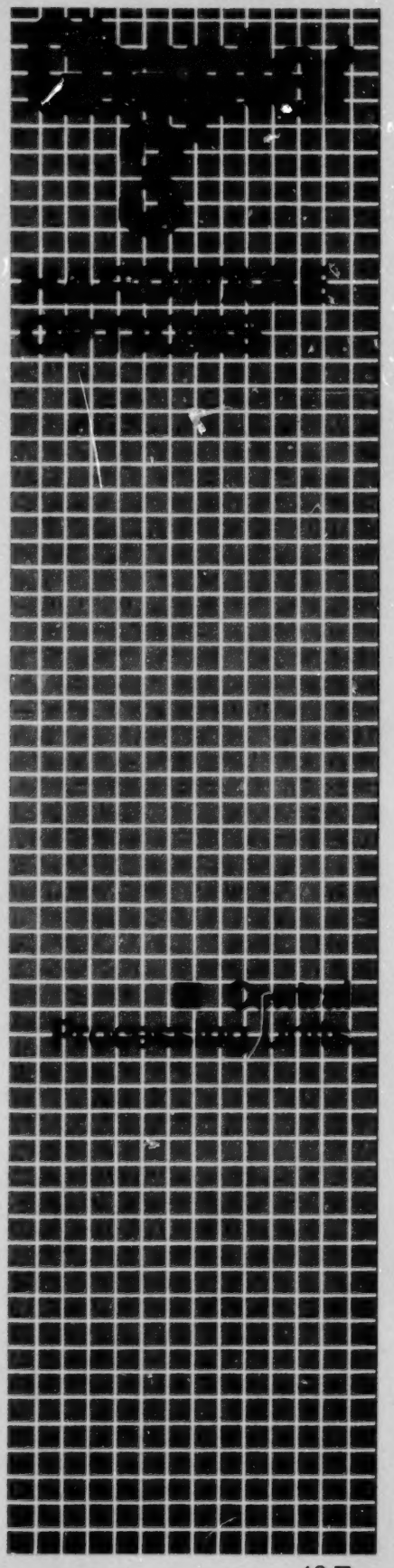
Many larger institutions have their own computer development centers that create in-house programming projects for various administrative groups within the university or college. If your institution has such a group, they should be your first contact when considering the need for a computer system. Depending upon workload and other factors, such a group may be your least expensive alternative when it comes to customized software. Even if they are incapable of providing you the services required, they should be able to point you in the proper direction for obtaining what you need.

## In-House Design

A newer concept in the area of in-house development of computer systems is the possibility of hiring your own programmer/analyst who will physically reside on site while performing the program development. There are some very real advantages to this approach that are clear to those who have already gone through the system development process. For instance, by residing on the premises the programmer gains a much better view of the workflow and how the proposed system must perform to be truly useful to the physical plant department. The programmer has a chance to try out various ideas and concepts with system users so that the finished product will better meet their needs. It can often be less expensive to hire your own programmer than to hire an outside firm, which must recover its high overhead costs. Finally, the system designer is on location during the implementation stage and is able to make quick adjustments to correct unforeseen problems.

However, the physical plant administrator should proceed cautiously in this area since a great deal will depend upon the skills and abilities of a single individual. You should choose candidates carefully and see that they have a proven track record. Ask for a list of references. Avoid the temptation of hiring a part-time person or student for the job. The position should be a full-time professional who can devote full concentration to the task at hand. Develop a realistic timetable at the beginning of the project that clearly defines the programmer's goals and deadlines. Finally, be certain that the person hired fully documents all of his or her work so that a new person or group does not have to begin from scratch should there be a change in personnel.

Only after you have carefully laid out all the factors—the resources available as well as the various options in the areas of system design, hardware, and software—should you make any major moves. By preplanning the major decisions in your system, you can save a great deal of wasted motion. To aid you further in the process of computerizing physical plant services, the next two chapters will deal in more depth with the hardware options available to you and the need for good software documentation. They are designed as a general overview for the person who has not been involved in the development or use of computers in an administrative setting. ■



Computer hardware consists of the actual physical components of the processing system. Before a physical plant administrator can make a reasonable decision on the types of equipment that would be appropriate, he or she should have some idea of which physical plant services will be computerized. Only after outlining these capabilities should you begin thinking seriously of purchasing or leasing the necessary equipment. If you decide to go with a turnkey system, the required hardware should be part of the total package. If, on the other hand, you will be automating only certain functions not part of a general system, select the hardware of your choice. This also applies for a custom software purchase, although in both cases you should carefully explore the capabilities and protocols necessary for your software purchase to operate properly.

Not all programs can be run on all hardware. Because of this lack of standardization it is important that the physical plant administrator know at least the basics of computer hardware design so that he or she does not make serious or irrevocable mistakes in this area. If you feel unsure at any time during the selection process, hire a consultant to help you make your decision or seek the advice of your software supplier. It is better to be cautious in the beginning than to be saddled with expensive, unusable computer equipment.

At the most basic level all computer systems consist of at least three separate types of hardware: a central processing unit (CPU), input/output (I/O) devices, and one or more auxiliary memory storage devices. We will explore each of these components by explaining what they do, how they work, and the various types available. While you will not be a computer expert after reading this, you will at least have acquired some extremely important background information. ■

Perhaps the most important part of any computer system is the **central processing unit**—CPU in computer shorthand. The central processing unit is the device that does the actual work within a computer and issues commands to all other parts of the system. It has no moving parts and is completely electronic. In fact, it is usually a relatively small device with a multitude of wires or cables leading to the other components of the system. Because of this, people are often disappointed when they see the central processing unit of a large computer system for the first time. They think it simply does not look big enough or impressive enough to accomplish the intricate tasks capable of a computer. This state of affairs has been made possible through the use of microchip technology.

The key to the power and versatility of most central processing units is the amount of **random access memory** (RAM) they possess. Modern digital computers store and manipulate data in small chunks known as **bytes.** Each byte is roughly equivalent to a single letter or number. While it may seem rather slow for us to work with such small pieces of information, the machine operates at an accelerated speed and can manipulate huge amounts of information in mere seconds. The size and difficulty of the programs a computer system can handle is limited by the amount of random access memory available to the CPU. For this reason, the power of a CPU is usually measured by the size of its random access memory in thousands of bytes (1K). Admittedly, this is a rather simplistic way to measure the power of the central processing unit and

completely ignores other factors such as cycle speeds and rates of data transfer. However, it is a common rule of thumb with which you should become familiar.

The question you might ask next is, "How much RAM should I have available to me?" While never satisfactory, the answer depends on what you intend to do with the machine. When considering stand-alone hardware for your physical plant operation, you should insist on a CPU with at least 64K (64,000 bytes) of random access memory. Anything under this threshold is more of a toy suitable for game playing rather than serious data processing functions. Your need for more RAM will increase dramatically if you run longer, more complicated programs. In fact, in larger mainframe computers RAM is measured in terms of millions of bytes (megabytes) rather than thousands of bytes. Usually the group supplying your software will be able to give some guidance on the minimum memory required for certain programs.

One item that should be looked at closely when purchasing a CPU is the amount of RAM actually available for use once the computer's operating system and/or programming language have been loaded into memory. Many manufacturers will state the total capacity of their CPU while never mentioning the fact that 20-50 percent of that total CPU capacity will be unavailable to any programs that may be running. Once again, closely investigate the various hardware alternatives and do not settle for something that looks good but cannot adequately perform the functions for which it was purchased.

Ask yourself if the central processing unit you wish to purchase has the ability to service several different users at the same time. You may or may not require this particular capability, especially if you have a relatively small operation. But larger institutions will certainly want to have a unit that is capable of serving multiple functions and users at the same time. Many of the smaller mini- and micro-computer systems are designed to serve only one user at a time or to perform only a single type of task. The capability of performing multiple tasks and serving multiple users simultaneously is sometimes called multitasking or multiuser capability and is just now becoming available for microcomputers. If you intend to have several different people using the system simultaneously, then you must make certain that your hardware is capable of supporting such an operation. ■

## ■ Input/Output Devices

### Terminals

If you wish to have a computer perform certain functions, you must have a way of communicating with the CPU. For this reason you will need some input and/or output devices. The most common form of such devices is a **keyboard** (very much like a typewriter keyboard) and a **cathode ray tube** (CRT), a display screen similar to a television screen. The combination of the keyboard and the display screen is usually known simply as a **terminal.** A computer can support the use of a single terminal or literally hundreds of terminals simultaneously. Nonetheless, there are certain hardware restrictions regarding what types of terminals can be used with certain types of central processing units. In addition, if your unit will be used in an office environment, you should make your selection carefully. Plastic molded keyboards, while fine for limited use at home, are unsuitable for constant office use. Remember that the keys on your unit will be depressed thousands of times per day—five days per week—for many years to come. Unless the unit is made to take such heavy use, you will likely have continuous problems keeping it operational.

A newer type of input device that is steadily acquiring more applications is a pen-shaped instrument often referred to as a light pen or scanner. Similar to the scanners now used in many grocery store checkout lines, the light pen reads a series of dark lines and converts those codes to meaningful information. A variation of this device reads plastic cards affixed with magnetic strips instead of

the bar codes. While still fairly new, these instruments promise to decrease errors and increase efficiency in areas such as inventory and stores management. If you intend to automate such functions, you should carefully explore the use of the light pen and other alternatives to keyboard data entry.

## Printers

Just as there are devices designed to enter information into a computer system, you must also have a means of taking information out. A CRT terminal can be used not only to enter data, but also to receive information back from the CPU. Unfortunately, such an output device also has major disadvantages. Once the information has been displayed on the screen, that is the last you'll see of it. When the screen is erased, there is no permanent record that the data ever existed. As a result, this type of output is neither permanent nor portable to other locations. For that reason one of the most common output devices in use today is the **printer.** A printer provides hard-copy output and a permanent record of certain occurrences. For instance, if you wish to automate your job order system, there must be a printer available to produce the actual job orders for field use. In addition, billing reports and management reports will have to be produced periodically for analysis and permanent record keeping.

There are many different types of printers on the market today with a wide variety of features and capabilities. In fact, this is one of the most rapidly changing areas of computer technology with new designs or models coming out almost on a monthly basis. Printers can basically be divided into two general categories, with several subtypes within each category. The most sophisticated and expensive category of printers on the market today are the non-impact variety. Such printers have no mechanical parts that actually touch the paper and, thus, tend to be quite fast. Such printers either use thin ink jets to spray letters on paper or laser beams in conjunction with xerographic processing to produce letters on paper. Except for high volume users, such printers are still too expensive for everyday use and probably have little applicability to the typical physical plant operation.

The more common type of printer in use today is the traditional impact printer in which some type of mechanical element strikes the paper with an inked ribbon to produce the image of a particular character. Of the impact printers there are two main types. The first works very much like a standard typewriter. Letters are fully formed and the finished product looks much the same as a standard typewritten page. For this reason they are called **letter quality printers.** Usually such printers use a print wheel, daisy wheel, or thimble, rather than the standard typing ball so familiar in today's office environments. They also tend to be somewhat faster than normal typewriters and are much more ruggedly built. Unfortunately, they also tend to be noisier than standard typewriters because of their greater speed. If you intend to use them in an open office area you should consider a sound-deadening box to surround the unit.

Much more popular because of their lower cost and greater flexibility is the **dot matrix printer.** This apparatus tends to be two to three times faster than letter quality printers and can handle a higher volume of work. Rather than using wholly formed letters, the dot matrix printer forms letters through a series of closely spaced dots that strike a sheet of paper through an inked ribbon. Controlled electronically as the print head moves across the page, small wires are raised to hit the paper in certain letter patterns. These printers vary in quality depending upon the spacing of the impact wires. A closely spaced matrix produces much higher quality characters (often called **correspondence quality letters**) than the coarser matrices. However, for most applications in the physical plant department this type of printer is ideal since it is relatively inexpensive and highly reliable. The only time that letter quality printers would be preferred are for word processing applications for which dot matrix printers do not produce as clear a copy.

One variation of the dot matrix printer uses wires to make impressions on a special silver or carbonless paper. Although less expensive on initial purchase than normal dot matrix printers, such printers should usually be avoided for everyday use. First, while they are initially less expensive, they also require special supplies that make this type of printer uneconomical tc operate. Second, the quality of the print on such devices tends to be poor and difficult to read at times. The normal ink-type dot matrix printer is far superior in almost every respect. ■

## ■ Auxiliary Storage Devices

The third major piece of hardware in most computer systems is some type of auxiliary memory device. The central processing unit cannot keep all the information it needs within its random access memory; in fact, the data within its RAM is lost each time the machine is turned off or loses power. It would be frustrating indeed to have spent hours entering data into a computer only to have it lost forever when you turn off the machine at the end of the day.

### Cards and Magnetic Tapes

The programs that tell the machine what to do should also be retained permanently so that they do not have to be entered from a keyboard each time they are needed. For this reason all computer systems should have some sort of permanent auxiliary memory device.

In the early days of computers this auxiliary memory was usually keypunched on manila cards and sent through a card reader to be input into the computer each time the information was needed. However, this was a slow process, and magnetic tapes soon came into wide use. The advantages of using such tapes were that they had a much longer life than paper cards, were much more compact, and could be accessed and read by the computer much more quickly than paper cards.

Magnetic tapes, however, suffered from some serious shortcomings in spite of their obvious advantages. Despite the fact that tapes could be more quickly accessed than cards, they were still slow by computer standards. And if the information required was located in the middle or end of a tape, nearly the entire tape had to be read before it could access this one piece of information—a time consuming and inefficient use of resources.

For these reasons, among others, most modern computer systems use magnetic tape primarily for archiving information. Data that is accessed frequently is stored on magnetic disks rather than tape. And because disks are round and compact, information can be accessed much more quickly on them than on tape. In addition, information can be accessed randomly rather than sequentially. This means that the computer can skip data that it does not need and go directly to the item or items it requires. As a result, you have a much more convenient and efficient method of memory storage than magnetic tape.

### Magnetic Disks

There are two main types of magnetic disks on the market today. Both have certain advantages as well as disadvantages attached to them. The first and most common type of disk used in the modern office environment is the "floppy disk." Floppy disks are thin pieces of plastic that are coated with iron oxide and permanently enclosed in a paper sleeve. Because of their pliancy they have been nicknamed "floppy disks" in order to distinguish them from rigid "hard disks," which we shall discuss in a moment. Floppy disk systems are ideal for the office environment since they are compact, easy to use, relatively inexpensive, and reliable in everyday operation. For these reasons they have proven to be an almost permanent fixture in smaller computer systems. Data contained on floppy disks can be read, modified, or deleted on command of the CPU. Disks can also be "write protected" to safeguard information contained on

them from being modified or erased. Programs and data can be easily changed by moving one disk and replacing it with another. Backup copies of data—to protect your database in case of disaster or equipment failure—can also be fairly easily created.

Perhaps the only major disadvantage to a floppy disk system is that it is distinctly limited in terms of storage capacity and speed. Depending upon the size of the disk itself and certain other factors such as data densities, rarely are floppy disks capable of containing more than 640K (640,000 bytes) of information. While this is a vast amount of data, for large data bases this is a limiting factor. Second, while considerably faster and more efficient than tape systems, floppy disks are still rather slow in comparison to a computer's ability to send and receive data. Because they are made of non-rigid material, floppy disks can spin at only relatively slow speeds, thus reducing the speed of data access.

For these reasons it is often more logical to opt for a more traditional hard disk system. Called by various names according to their design, the most popular type today for smaller computer systems is the so-called "winchester" disk. The obvious difference between floppy disks and hard disks is that hard disks are made of rigid materials and to much higher tolerances than floppy disks. Because they are precision-designed items, most modern hard disks are permanently emplaced units. While one can easily change floppy disks, most hard disks are sealed within the disk unit and cannot be removed. They are carefully balanced pieces of integrated hardware, which allows the disk to spin at an extremely high rate of speed. This, in turn, reduces the time lag found when using floppy disks. Because they are better constructed, hard disk systems are capable of storing enormous amounts of data.

The limits of this storage varies according to the specific design of the system as well as the actual number of disks contained in a single unit. For smaller, single disk units they typically range from five to fifty megabytes (5 million–50 million bytes) of storage. Larger units used with mainframe computer systems can store many times this amount of data in a single unit.

Hence, hard disk units are ideal for mass storage that can be easily and quickly accessed by the CPU. Unfortunately, you pay for these advantages. Hard disk systems cost significantly more than the floppy disk units. Even the least expensive, low capacity units will cost at least five times more than a floppy disk unit. However, if you require more storage capacity than can be reasonably obtained from floppy disks, hard disk units are well worth the investment. In fact, many systems combine a primary hard disk unit with a backup system using floppy disks. ■

## ■ Reliability, Service, and Total Costs

One item that we have yet to consider in the area of computer hardware is the question of reliability and service of the equipment. Because modern equipment is microchip-based, it tends to be very reliable. You can expect the mechanical portions of the system to require periodic service from a technician, much as you would service any other piece of office equipment such as a typewriter or dictaphone. However, you should not consider all computer hardware to be equally reliable or desirable. As in any young and rapidly expanding enterprise, there is an extremely high rate of turnover among computer manufacturers today.

For this reason it is usually best to stay with well-known, solidly established equipment manufacturers if you intend to purchase a computer system. Thoroughly explore the availability of service on the machines you are considering. If possible, buy hardware that is serviced locally, but always consider the possibility of a service agreement with the manufacturer or a local distributor. You can usually expect such service contracts to cost approximately 10 percent of the initial purchase price per year.

Remember also that the average life cycle of modern data processing equipment is approximately five years. At the end of that time period your present equipment will undoubtedly be obsolete and a replacement may be necessary. Hence, when adding your costs together, do not neglect the yearly depreciation and service costs. Note that many companies will provide you with spare equipment while yours is being serviced, but you might want to consider buying an extra CRT or small printer to be used as backup.

Another concern to take into account is the addition of personnel required to complement your equipment purchase. For larger, stand-alone computer systems it is usually necessary to employ a full-time programmer/analyst/operator to assure yourself of a smoothly operating system. Alternately, it may be possible to retain current employees to act in this role—expecially if you purchase a turnkey system from an outside vendor. Even here it is wise to have expert help on a regular basis. This is particularly true during the early implementation of the new system. It is usually inappropriate to simply designate one clerical person to operate the entire computer system, especially if it is fairly complex. Before you set out to purchase hardware independently, carefully consider all of your costs and weigh them against the costs involved in contracting with a service bureau or making arrangements with the campus computer center. ■

# CHAPTER 4

# SOFTWARE DESIGN AND DOCUMENTATION

The essence of modern data processing systems is surprisingly simple and has not changed significantly since computers were first used in business applications. The centerpiece of all computerized management systems is a large mass of information called a data file or database that is manipulated or processed in various ways. Computer software programs are used to add new information to the existing file, to retrieve certain bits of information, and to rearrange information to fit a variety of needs. What distinguishes modern, complex programming systems from older models is that information in one file is often processed and then used in combination with other files of data for numerous purposes. This sharing of data among different systems reduces the need for human intervention and eliminates the duplication of data entry. For these reasons more and more organizations with computer systems are integrating their data files so that they can use their machines more efficiently.

## Modular Design

One aspect of computer software which you should bear in mind is whether the package you purchase or develop is modular in nature. Modular software is developed in independent segments and can function separately or in conjuction with one another. If you decide to automate your operation in phases, you would simply develop or purchase the software modules as needed. You would have a comprehensive physical plant automation system when all the modules are used.

By structuring your overall software plan into segments in this way, you can provide for future growth and development. For instance, a certain function may not require automation at this point, but several years from now you possibly may need such a system. If you do not plan ahead for your future needs in this manner, the second or third stages of your automation project could require extensive changes in software already in operation.

## Four Characteristics

What distinguishes one type of software from another can basically be broken down into four characteristics.

1. **The flexibility of the software;** or, the ability to adapt the software to changing needs and circumstances, as well as the ability to cope with unusual cases. Not all software can meet this test and older systems that do not use system tables tend to be extremely rigid. This is because such systems were designed to meet the specific and narrow needs of a particular location or institution and were seriously constrained by early hardware limitations. Rarely are they able to grow and change as the circumstances or needs of a particular department change.

2. **The reliability of software varies.** Software that is not fully tested and carefully written can often contain hidden bugs that can cause unreliability in operation. Obviously, you do not want to stake the continued operation of your department on software that is untested and unproven in the field.

3. **Some software is simply easier to use.** If a software system is not carefully designed with the needs and capabilities of the end user firmly in mind, it tends to be bulky and difficult to use efficiently. Such programs also tend to be

abandoned at a rapid rate since they do not truly fulfill the needs and desires of the user.

**4. Software tends to vary in its efficiency of operation.** While not quite as significant as it used to be, it is still important that programs be written to use as few of the computer's resources as possible. This is especially true in a time-sharing environment in which the resources of a mainframe computer are being shared by many users simultaneously.

The software itself will, of course, vary according to the type of hardware it is designed for. Software designed to be run on large mainframe computer systems tends to be somewhat more complex. Because the capacity of these machines is significantly greater than can be found in mini- or micro-computers, these programs can offer more conveniences as well as being more comprehensive in nature. Such software also tends to be more flexible and fully integrated than can be found among programs intended for use on small systems. Software intended for use on mini- or micro-computers tends to be simpler than that found on mainframes because of the distinct limitations on these machines' memory capacity. In addition, they also tend to be less portable in nature since software designed for one manufacturer's machine is unlikely to work on another's without major modifications. While the small computer industry is slowly moving toward common hardware and software standards, completion is still years in the future at this time. ■

## ■ Programming Languages

### For the Mainframe

The most common programming languages used with modern mainframe computers are COBOL (COmmon Business Oriented Language), FORTRAN (FORmula TRANslation), and PLI (Programming Language I). All of these programming languages are capable of complex functions on extremely large groups of data. They also offer many features that are simply not available to users of small computer systems. For applications involving most areas of physical plant operations, the top choices would be COBOL or PLI. But to a certain extent the precise choice of language is irrelevant.

The most important factor to consider is whether the language used is well enough known that someone within the institution would be able to correct any software difficulties as well as make needed changes. The major advantage of having your software written in COBOL or PLI is the fact that these are portable languages supported by most computer manufacturers. Thus, if the hardware at your installation should change, your software system could still be run on the new computer system.

### For the Mini or Micro

Programs written to run on mini- or micro-computers are normally written in either BASIC (Beginners' All-purpose Symbolic Instructional Code) or ASSEMBLER. These programming languages are often referred to as lower level languages since they do not offer the range or flexibility inherent in COBOL or PLI. The reason for this is the limited memory capacities of these smaller machines. In order to leave enough random access memory to actually perform the work, small computer system software designers have been forced to design languages that offer the basic programming functions and little else. While some manufacturers have attempted to come out with micro versions of COBOL and FORTRAN, such translations are still in their formative stages and have yet to be widely used.

This does not mean that physical plant services cannot be automated through the use of mini- or micro-computers. It only means that such programs are likely to be less complex and all-encompassing than would be found with mainframe oriented systems. It usually also means that one function, such as inventory

control, cannot be integrated with other functions, such as a job order and dispatch system. ■

## ■ System Analysis

A great deal of the work involved in developing a software system for an office environment does not involve the time and effort of a computer professional. In fact, the more time spent by the people for whom the software is being written in outlining, debating, and clearly delineating what they want, the more successful the entire process will be. Too many managers fail to realize that they, as well as their staff, are the best judges of what they really need from a computer system. It is these people who must come up with a clearly specified method of operation for the software.

The process of accomplishing this begins at the most fundamental level. All persons involved in performing a certain function must clearly outline what they do and how they do it. They must also indicate how the actions they perform affect what other people do. All of these actions must then be put together and made part of a flow chart which indicates the decision process at each stage of a particular operation. Once this is done, the whole operation must be abstracted and rationalized. Duplicative functions should be eliminated and the process streamlined to make it amenable to automation. Only after all this has taken place should a programmer be brought in to translate the operation into a computer software system.

Those who attempt to automate their operations without going through this or a similar process are often disappointed by the results. The simple fact is that computerizing a poorly designed or undeveloped function does not suddenly make it efficient or effective. A computer is not a cure for bad management or poorly trained personnel. An exercise in physical plant automation must begin with a well thought out plan and a staff dedicated to a successful conclusion. Unless a manager is willing to devote enough time to the project, it will not be truly effective. ■

## ■ Documentation

Another key to an effective software system is how well it is documented. You should beware of software which has little written documentation on how it works and what it is capable of doing. Good documentation should cover at least seven areas: 1) data elements, 2) input procedures, 3) output procedures and options, 4) a detailed description of the system operation, 5) a diagnostic section to help you correct common problems, 6) a training manual for operators and, 7) a programmer's guide giving the technical details of operation. In addition, the documentation should list who to contact in case you encounter software problems. A simple listing of a contact person is no guarantee that the seller will be helpful in all circumstances, but not listing a source for user support is a definite indication that you will be on your own.

### Data Elements

One of the most important parts of any documentation package is the data element listing. While it may seem initially imposing, a data element listing is nothing more than a complete listing of all the variables on the computer file and pertinent information about each one. For instance, if you wish to keep track of the maintenance on your vehicle fleet, your data elements would consist of such items as the vehicle's ID number, the last date on which the oil was changed, and the make and model of the vehicle. Of course, the complete data element dictionary is somewhat more extensive than simply a list of variables.

First, it should give a complete definition of each element on the file. Second, it should list the length of the variable and whether it is numeric or alphanumeric (i.e., is the item a number or a letter and, in addition, how many spaces can the item take up?). Third, if the item is to be coded in some way, the data element

dictionary should note what that particular variable is used for, how its coding will affect the programs, and what the various codes mean. In sum, the data element dictionary should give you a complete picture of the data that must be input to the system and what that information means.

## Input Procedures

The second part of any software documentation is the description of the input procedures. This section should explain in detail how information is to be entered into the computer and what happens to the information once it is input. Obviously, a software system does you little good if you cannot get information into it for processing. For this reason both the physical plant manager and the staff members who use the system on a daily basis should carefully evaluate this aspect of any prospective software. The modern standard for data entry is the use of CRT terminals to interactively enter information into the computer system. Such data entry functions are usually controlled through a series of menus and entry panels as illustrated later in this publication. Most modern data entry panels also function as editors of the information that is input by the operator.

For instance, if the entry operator makes an error and attempts to put a letter or letters in a numeric field, the panel software should at least warn the operator of the possible error before accepting it. This also makes it fairly easy to correct data that has previously been entered in error. These features help to reduce entry problems and thereby also reduce the amount of erroneous information that could inadvertently be placed into data files and never corrected. If the software documentation does not outline such an entry system, be sure to carefully evaluate the method used to make certain that data entry does not become a large burden to your operator.

## Output Procedures

Equally as important as putting information into your software system is what the documentation says about data retrieval. Just as you must make certain that initial data entry is simple and straightforward, you should also feel confident that the software is able to generate the types of reports you desire. You should be sure that there are options that would allow you to generate your own custom reports. For instance, managers often will need to have the same information sorted several different ways. Any software system you are contemplating should have the capability of generating custom reports if needed. If it does not, it is almost certainly too rigid in nature to be truly useful and capable of responding to managerial needs.

## Sequence of Operation

Any software documentation should contain a complete description of the system's operation. It should describe such elements as the architecture of the file, what sort of processing takes place within the programs, and how it is likely to react in certain situations. The system should not be a "black box" to the people who are using it on a day to day basis, because if they fail to understand the workings of the software, they will not be prepared to use it well. It is important to know how the various parts of a software system interact with one another. Only by knowing these specifics of operation can one really evaluate whether a particular system will do what is wanted.

## Diagnostic Aids

No matter how good the software design and operation, there is always the possibility that things will go awry. For this reason all software documentation should contain a diagnostic section that will allow the user to pinpoint the problem and correct it if at all possible. Many software systems generate error messages and codes when they encounter major problems. By having a list of

these error messages—with their meanings and instructions for correcting the problem—you can probably resolve any difficulties on your own. If you encounter problems not covered in the documentation, there should always be a person or organization to contact for support services. The purpose of such a reference is to allow the user to bring to the attention of the software designer any possible bugs or discrepancies in a product.

Although software is not warranted in the usual sense of the term, a responsible software producer will support their product. This means that they will attempt to correct omissions or errors in their software at little or no cost to the purchaser. If the documentation contains little in the way of diagnostic or support information, be extremely wary of it. If it does not work properly, you could well be out your entire investment.

## Operator Training Manual

Another part of good system documentation for more complex or comprehensive software systems is an operator training manual. This training document should be designed for everyday use by the people who will have to work with the system on a regular basis. It should be more general in nature but should clearly explain, step by step, all of the procedures necessary to keep the software operating properly. If the original software documentation does not contain a section like this, you will probably have to devise your own manual for training purposes. Hence, if the software documentation already has such an item, you will likely save yourself a great deal of work. Some microcomputer software manufacturers are now putting training materials on floppy disks supplied with their software. This allows the average user to learn the system directly at the terminal rather than by reading a manual.

## Programmer's Guide

Finally, a fully documented software system is not complete without a programmer's guide. This document is intended for system programmers or a similar individual with detailed knowledge of operating systems and programming languages. It is not intended to be a user friendly document. Instead it is intended to give very specific, detailed software information that would be useful to the technically oriented person. Not only should it give detailed information about the software itself, it should also describe any memory or hardware limitations that are imposed by the software. For instance, you will have to know how many data entry operators or remote locations can be supported by the software.

Oftentimes it is necessary to customize software somewhat for a particular situation at an institution. In order to do so a systems programmer generally must see the actual programs themselves (often called the source code). For this reason the programmer's guide is often nothing more than a printed copy of the programs that comprise the software system. If for no other purpose than to fully document your software programs, you should always attempt to obtain such a document. This is especially true if you are unsure if the software vendor will really support his product. With the source code you will at least be able to hire someone to work out any bugs in a system that is abandoned by its vendor. ■

# Part 2

## A MODULAR APPROACH TO IMPLEMENTATION OF SAMPLE PROGRAMS

# 5

## FACILITY MAINTENANCE

These chapters present conceptual data processing solutions for six specific services of the physical plant department [**Illustration 1**].

These examples are not meant to be comprehensive or exhaustive and, in fact, some programs may be combinable in your operation. These samples are meant to stimulate, and using this information as a guide, a physical plant department can select the most applicable elements and develop a practical system for its own operation. Thus, modification of the elements may be necessary to meet the unique requirements of each physical plant department. ■

The physical plant department service menu is the starting point for the computer or terminal operator. To access a service the selection number of the service is keyed onto the selection line. A command key is depressed and information relative to that service appears on the screen [**Illustration 2**]. This particular service is designed to manage information pertinent to six aspects of facility maintenance: maintenance dispatch, work order, equipment master, preventive maintenance master, maintenance forecast, and deferred maintenance. Repeat the selection number process when you wish to access a specific aspect or file.

### Selection 01 — Maintenance Dispatch

The maintenance dispatch system receives verbal requests for priority service and quickly routes the information to the appropriate craft or trade. When the physical plant department is contacted, the request for service is qualified. If an immediate response is necessary the request is keyed onto the screen [**Illustration 3**]. The information is then printed on a work order by depressing a key that signals the computer to print the information on the screen.

ILLUSTRATION 2
FACILITY MAINTENANCE MENU

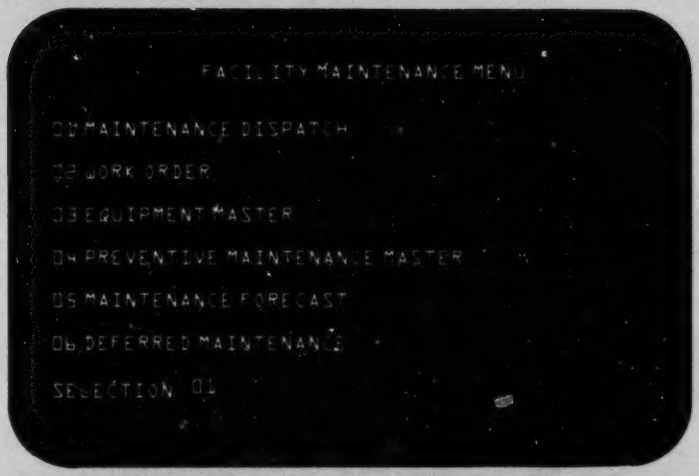
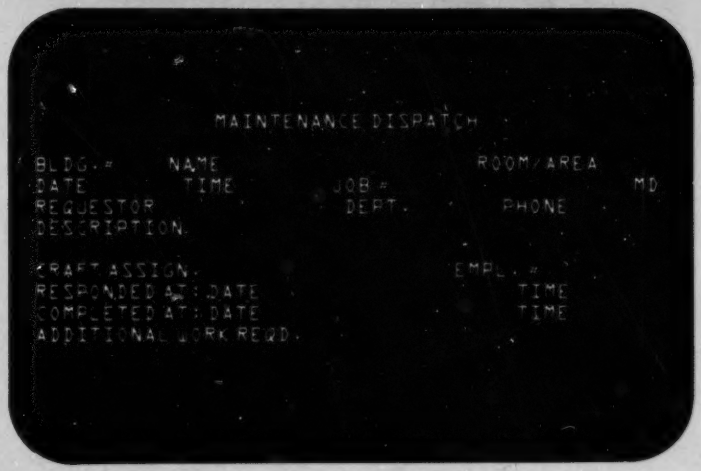


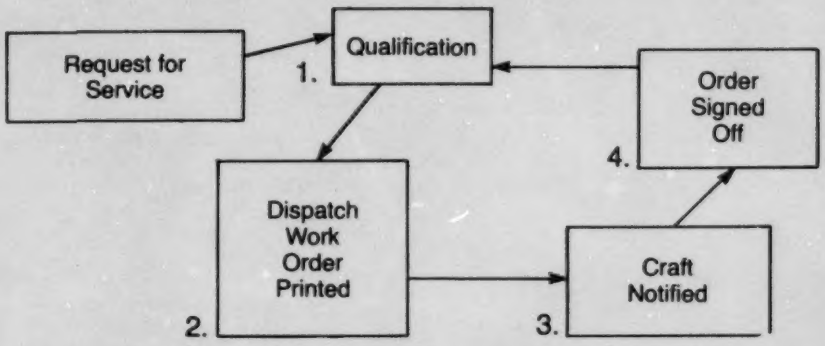

ILLUSTRATION 3
MAINTENANCE DISPATCH
SYSTEM




An employee is dispatched when the appropriate craft receives the work order from the campus department requesting the service. If the problem is corrected in its entirety, the work order is signed off and the information, dates, times, craft assigned, and employee number are entered into the dispatch system where the data are stored in a history file. If additional service is required, the dispatch work order indicates that a response was made and temporary measures were applied. The work order remains open and is then forwarded to a planner or estimator who reviews the nature of the work, coordinates labor and material requirements, and schedules future service by entering the information into a work order system that is separate from the dispatch work order system.

Computerizing automates the recording of priority requests, generation of work orders, and dispatch of personnel. You maintain system continuity as temporary and permanent repairs are made.

ILLUSTRATION 4
WORK ORDER FLOW CHART



1. Physical plant department receives a request for service. The request is qualified and pertinent information is keyed into the dispatch system.
2. A dispatch work order is printed and the appropriate craft notified.
3. The problem is identified and corrective action taken.
4. The dispatch work order is signed off and compliance data entered into the system. If required, additional work is planned and scheduled.

## Selection 02—Work Order System

The work order system is designed to control physical plant department resources—labor, budget, and stores or materials. The work order is used for emergencies or for elective maintenance planned by the physical plant department, as well as requests made by the campus community.

Computerizing the work order system automates the assignment of job numbers to work orders, even in multiuse situations where systems users are in several locations. When the work order system is accessed, the next chronological job number appears on the CRT screen within the work order format. The work order information is then keyed onto the screen and entered into the work order system. A work order system should provide for the creation of work orders, summarize backlog, and store historic work order data.

### ■ Work Order Entry

All work requests are written on a work request form by the originator and forwarded to a physical plant department coordinator for qualification, planning, scheduling, and materials requirements. The request is then entered into the work order system.

The work order is automatically scheduled when craft identification and the number of hours required to complete the job are entered into the work order system. The software program contains the manhour availability of each trade on a daily basis. As work orders are entered into the system, estimated completion hours for the appropriate craft are automatically entered into the matrix. Through formulated programming the schedule date is determined by calculating both the daily available manhours and the manhours required to complete the present job.

### ■ Work Order Backlog

All work orders not completed at a programmed interval beyond the due date automatically appear in the work order backlog. The backlog lists overdue work orders by craft, order of urgency, due date, and job number.

Depress the appropriate command key and you will receive a printout of the backlog report. You should review this report weekly and reschedule backlogged work orders as required.

ILLUSTRATION 5
WORK ORDER BACKLOG REPORT

WORK ORDER BACKLOG REPORT

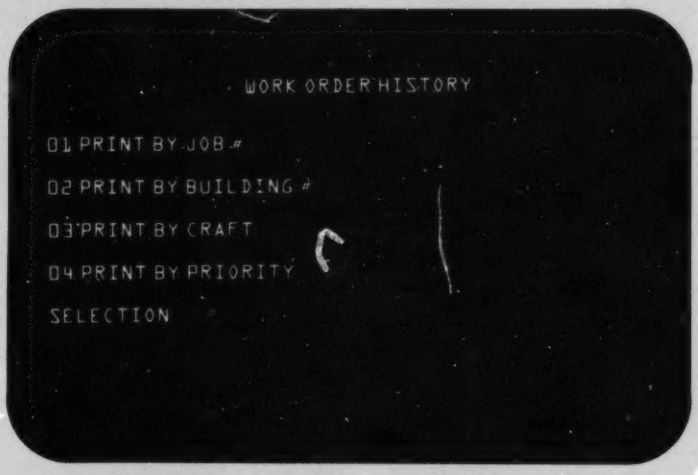
REPORT DATE 08-01-83

| CRAFT | SCHEDULED DATE | W.O. NO. | TYPE | BUILDING # | ROOM/AREA | RESCHEDULE DATE | REMARKS |
|---|---|---|---|---|---|---|---|
| 08 | 05-09-83 | 2112 | P.M. | 046 | 217 UTIL | _____ | _____ |
| 112 | 05-26-83 | 1310 | E.W. | 046 | 217 UTIL | _____ | _____ |
| 33 | 05-29-83 | 1946 | D.M. | 046 | ROOF | _____ | _____ |
| 08 | 06-08-83 | 1976 | P.M. | 046 | 410 ACAD | _____ | _____ |
| 19 | 07-01-83 | 1947 | P.M. | 046 | 139 OFF | _____ | _____ |

### ■ Work Order History

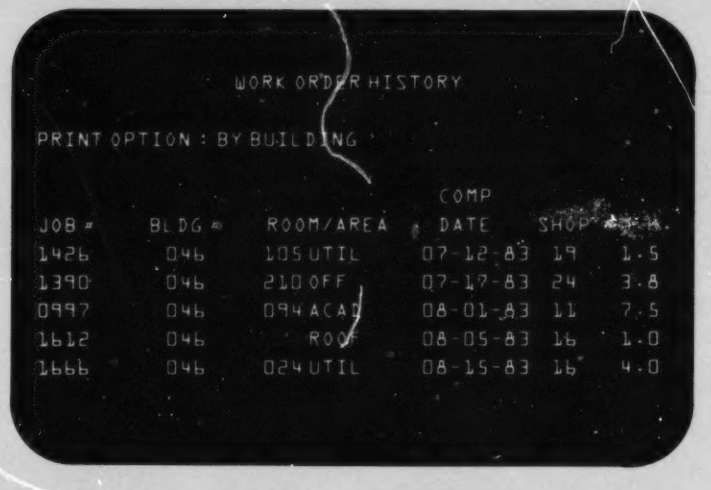
The work order history file is used to store pertinent information about each completed work order. **Illustration 6** depicts four report options for historic information printing. Select option 02 if completed work orders by building for a specific time period are required.

ILLUSTRATION 6
WORK ORDER HISTORY




The computer scans the history file and a work order listing by building number appears on the screen [**Illustration 7**]. The information can also be printed.

ILLUSTRATION 7
WORK ORDER HISTORY BY BUILDING




## Selection 03 — Equipment Master

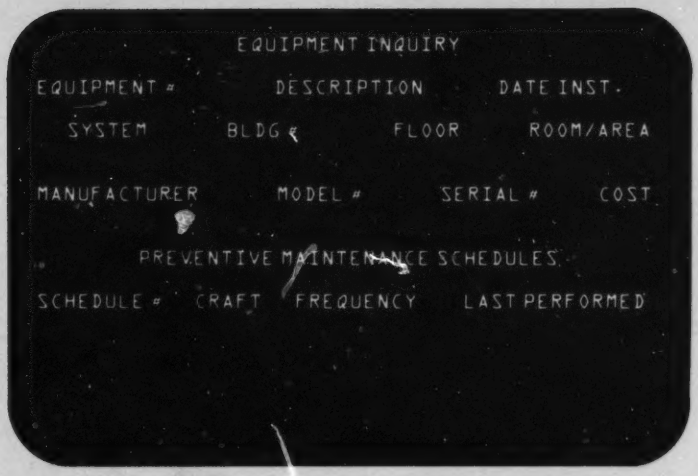
The **equipment master** is the library of equipment or building contents. Generally, all equipment requiring preventive maintenance is entered into the library. Examples are boilers, oil burners, hot water heating systems, rooftop air conditioners, air handlers, hot water heating/cooling coils, compressors, transformers, pumps, etc. This library must be established before preventive maintenance or parts inventory programs can be implemented.

In this application the equipment master consists of three files. They are equipment inquiry, bill of materials inquiry, and equipment history.

### ■ Equipment Inquiry

The **equipment inquiry** file is a data bank used to store pertinent information about the equipment. **Illustration 8** depicts the kinds of data that can be stored in the file. Refer to this information when ordering parts or planning overhauls.

ILLUSTRATION 8
EQUIPMENT INQUIRY FILE




Before equipment data can be entered into the file, it must be collected. You can accomplish this by making field inspections, affixing equipment number tags, and recording information found on name plates. A data collection form similar to the screen format in **Illustration** 8 should be used for gathering the information. The lower half of the form is completed after the preventive maintenance schedules are developed for the equipment.

### ■ Equipment Numbering System

You should develop an **equipment numbering system** so that each piece of equipment entered into the master menu is assigned a unique number for identification purposes. Identity is required by the computer as well as staff members who will locate the equipment and perform the maintenance. In essence, the equipment number is the "address" of each piece of equipment. It is common practice in conventional record keeping systems to devise a numbering system that identifies both the building and the kind of system supported by the equipment. This is not necessary and may prove to be cumbersome as equipment is moved to another location and used in a different building system.

The numbering system should be comprised of eight to twelve digits in order to meet present and future needs. An equipment number should be used for one function only, the equipment identity. Provisions are made for the equipment number, building number, and system identification. It is not necessary to codify other information into the equipment identification number.

Equipment identification numbers can be printed on metal or plastic tags, or on continuous rolls of white tyvec with a mylar overcoat to protect it. The identification numbers can be affixed to the equipment by means of adhesive, wire straps, or rivets. A combination of applications may be necessary depending upon the environment of the equipment. The tags should be mounted in common areas, such as next to the equipment manufacturers identification plate. When the numbers must be recognized at a distance it may be necessary to affix large characters.

### ■ Bill of Materials Inquiry

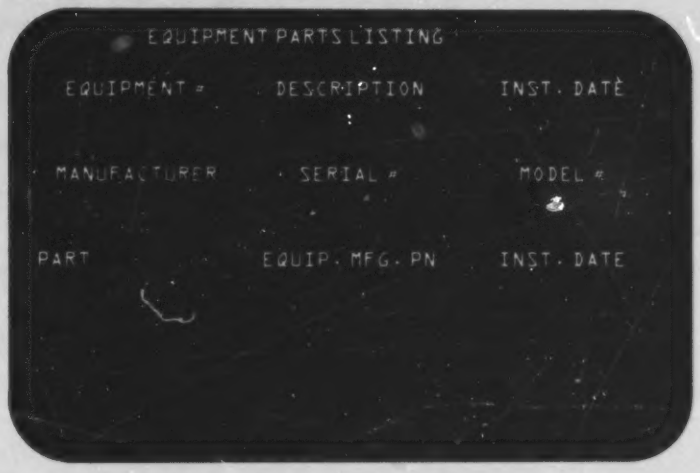
The **bill of materials inquiry** is a listing of the parts that constitute a piece of equipment. The listing may consist of every part in detail or only major individual components and recommended spares. You can obtain a parts breakdown and other relevant information from the illustrated parts listing that usually accompanies equipment purchases. If the listing is not available contact the equipment manufacturer for a copy.

The bill of materials listing can be designed as a part number referral only, or it can be expanded to contain historic information and linked to an inventory control system. After you have brought the bill of materials inquiry up on the

screen, enter the equipment identification number and depress the command key to access the material listing.

**Illustration 9** depicts a listing of parts and corresponding part number as designed by the equipment manufacturer. Refer to this file when you need to know the manufacturer's part number. Also appearing is other information pertaining to the piece of equipment. All of the information on the screen can be printed and attached to a purchase requisition.

ILLUSTRATION 9
EQUIPMENT PARTS LISTING BY
EQUIPMENT MANUFACTURER'S
PART NUMBER

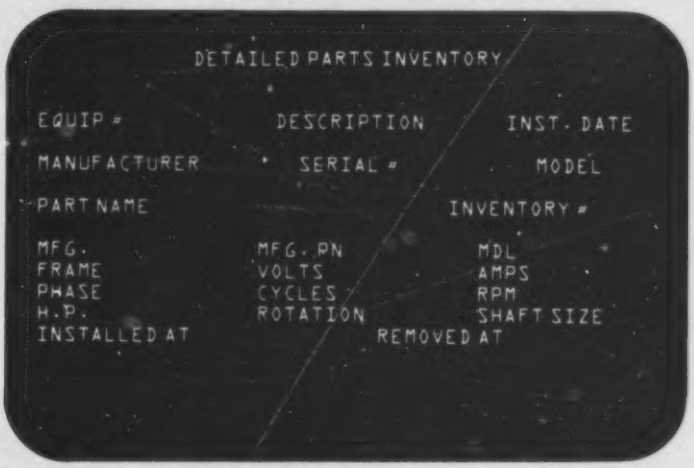



The bill of materials inquiry can be expanded in detail by assigning an identification or inventory number to each part. This provides for the recording of specific information about individual parts. For instance, an equipment manufacturer's part number may not be common or generic and is assigned for the manufacturer's benefit only. To procure the part from a source other than the equipment manufacturer, you must know more specific information including the part number.

To provide for greater detail, a numbering system of at least six digits must be implemented. Three of the digits identify the part, and a fourth controls the screen format on which supporting information will appear. The format will vary based on the type of part, such as with a motor or a bearing. Supporting information for each of them is unique to the respective part. Two formats will accommmodate most situations.

In addition to the equipment manufacturer's part number appearing as in **Illustration 9**, the system can be expanded to contain an inventory number. Enter the inventory number onto the screen and depress the command key. Detailed information about the part will then appear on the screen [**Illustration 10**].

ILLUSTRATION 10
DETAILED PARTS INVENTORY
DATA FOR A MOTOR



## ■ Equipment History

The equipment history file is used to store information that can be referred to during the decision-making process. Parts replacement, compliance of preventive maintenance, and expenditures in dollars and hours are the kinds of information that are cumulatively and chronologically stored in the history file.

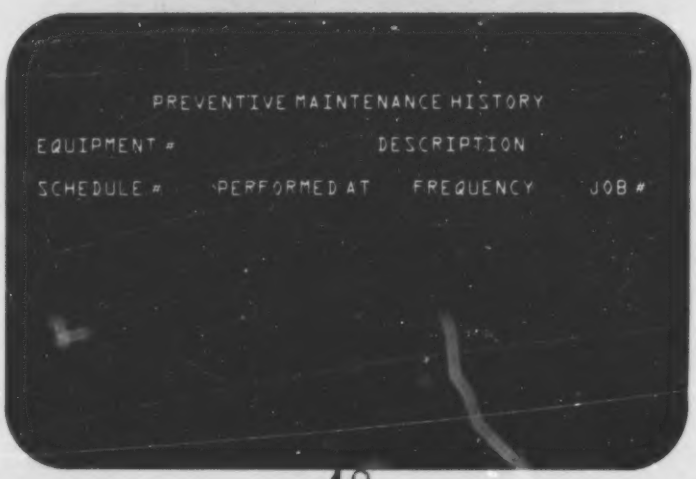
A history file may not be required if historic record keeping is not essential in your operation. Some recent historic information is retained within the equipment inquiry file [see **Illustrations 8 and 10**]. Installation dates and last performed dates for equipment installation, parts replacement, and preventive maintenance are on record.

Historic record keeping is a function that is generally programmed to work automatically. When there is an occurrence of a maintenance transaction, parts replacement, or compliance of preventive maintenance, the information is entered into a file where current data are stored. This information also enters a cumulative history file. In this application, the bill of materials inquiry file and preventive maintenance file show current information and the last time a part was replaced or a task completed.

Enter an equipment identification number or inventory number onto the screen. If you enter the inventory number, historic information about the part will appear [**Illustration 11**]. **Illustration 12** depicts historic preventive maintenance information that is contained separately in this application. However, an equipment history file can be designed to contain all historic data about each piece of equipment.

ILLUSTRATION 11
PARTS REPLACEMENT HISTORY

ILLUSTRATION 12
PREVENTIVE MAINTENANCE
HISTORY



### ■ Utilizing the Equipment Master System to Replace Equipment Parts

1. Maintenance personnel respond to a reported equipment failure. They determine that a part is defective and must be replaced.

2. The equipment identification number is recorded on a work order with the nature of the problem and part required.

3. A terminal operator brings the equipment master menu up on the screen and selects the bill of materials inquiry file. The equipment identification number is entered on the line, and part number information appears [see **Illustration 9**].

4. The operator obtains from the file the number of the part to be replaced. The part is then drawn from maintenance stores or is purchased commercially.

5. Maintenance crews replace the part and the work order is signed off and updated.

## Selection 04 — Preventive Maintenance Master

In this application, separate preventive maintenance programs are utilized for the equipment maintenance requirements of each craft. This applies to building maintenance, groundskeeping, housekeeping, and vehicle maintenance. However, it is possible to combine the preventive maintenance requirements of all equipment into one program.

The preventive maintenance master consists of two files — the preventive maintenance library, a data bank of preventive maintenance procedures; and the preventive maintenance/equipment inquiry, a cross reference of preventive maintenance procedures assigned to the various pieces of equipment.

### ■ Preventive Maintenance Library

The library is established by writing preventive maintenance procedures for the equipment and keying them into the library file. The procedures are keyed onto a screen format resembling a preventive maintenance card called a P.M. schedule.

There are two alternatives to procedure writing: writing **generic specifications** for like types of equipment, or writing **specific procedures** for each piece of equipment. Writing specific procedures will increase the number of P.M. schedules within the library and lengthen the implementation process. A prerequisite to choosing this alternative is to know the limitations of the computer and software as well as the cost of expanding the system, if necessary. An advantage of writing specific maintenance procedures is that the technical details of each piece of equipment can be written into the P.M. specification.

Generic preventive maintenance procedures are acceptable in most applications. But we must emphasize that equipment, even like equipment, requires varying degrees of preventive maintenance. This is based upon operating environment and the equipments' application and utilization. Thus, flexibility must be considered when establishing preventive maintenance requirements.

The amount of information that can be printed on a P.M. schedule varies by the number of characters the schedule is designed to contain. A system may be capable of printing both a limited amount of information [**Illustration 13**] or an expanded listing [**Illustration 14**].

### ■ P.M. Card Format

The preventive maintenance card format is designed for the information printed by the computer as well as the information recorded by the mechanic. The computer will print out the equipment identification number and location, P.M. schedule number, time the task is due, and the task procedure.

When the P.M. schedule is completed, pertinent information relative to the job is

ILLUSTRATION 13
PREVENTIVE MAINTENANCE
SCHEDULE WITH LIMITED
INSTRUCTION

PREVENTIVE MAINTENANCE PROGRAM

SCHEDULE NUMBER 355.0
TASK DUE AT 10-28-83 DATE GENERATED 10-21-83
MAINT. ID. NUMBER 01-33287 EQUIPMENT DESCRIPTION COMPRESSOR, DBL. ACT
TASK 30 DAY SERVICE/INSPECTION
COMPLIED WITH AT DATE _____ HOURS _____
# HOURS _____ MECHANIC _____
SUPERVISOR _____
ADDITIONAL WORK REQUIRED _____

ILLUSTRATION 14
PREVENTIVE MAINTENANCE
SCHEDULE WITH DETAILED
INSTRUCTION

PREVENTIVE MAINTENANCE PROGRAM

Schedule Number 335.0
Task Due at: 10-28-83 Date Generated: 10-21-83
Maint. ID. Number: 01-33287 Equipment Description: Compressor, DBL . Act
Complied with at date _____ Hours _____
Task: 30 day service/inspection

1. Drain oil filter and clean filter element
2. Operationally check all pressure and shutdown switches
3. Check and clean intake filtering element
4. Operationally check moisture traps
5. Operationally check safety valves
6. Check pressure gauges for accuracy
7. Check discharge temperature of cooling water
9. Check oil level in compressor crankcase
9. Check pressure controls for proper operation

# Hours _____ Mechanic _____ Supervisor _____
Additional work required _____
Remarks _____

recorded. This includes number of work hours expended, date completed, and the mechanic's signature. It also indicates if additional work is required.

The preventive maintenance tasks can be printed on standard computer paper or preprinted maintenance cards that are fed into the computer printer. The P.M. schedules can be printed on one-part, two-part, or three-part paper as needed.

### ■ Establishing Frequencies of Preventive Maintenance

Equipment manufacturers generally recommend that preventive maintenance — in the form of inspections, servicing, and component changeouts — be performed as equipment attains a given number of operating hours, starts, or calendar time. Frequencies of maintenance can be established by reviewing equipment manuals, contacting manufacturers, or making a determination based on experience, operating conditions, or present practices. For new equipment under warranty it is advisable to adhere to the manufacturers' maintenance recommendations in order to satisfy warranty requirements.

Once the preventive maintenance library is established, refer to it when adding or revising maintenance procedures. To access the library, the preventive maintenance master menu is brought up on the screen and selection 01 entered.

PREVENTIVE MAINTENANCE MASTER MENU

01 P.M. Library
02 P.M. Equipment Inquiry
Selection _____

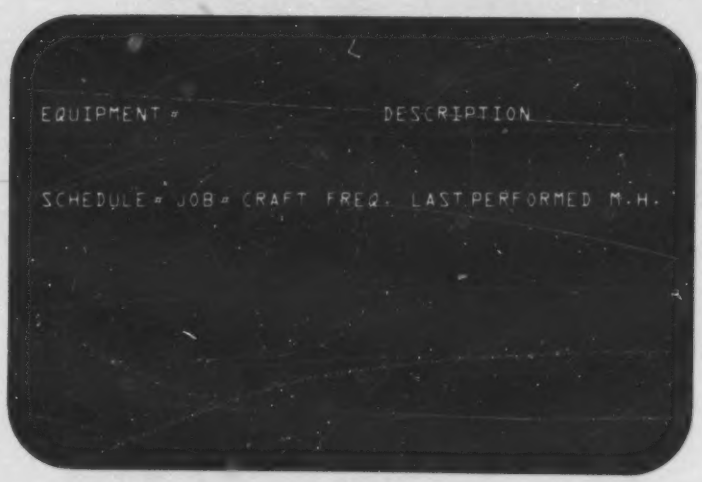
Depress a command key and the screen format for the preventive maintenance library appears. Enter the P.M. schedule number onto the screen; again depress the command key and the schedule will appear. To create a new schedule enter the next unused schedule number and repeat the selection process. A blank preventive maintenance schedule will appear and the maintenance information is keyed onto it. Repeat the command key process to enter it into the library. The preventive maintenance schedule is assigned to the appropriate equipment via the preventive maintenance/equipment inquiry file.

### ■ Preventive Maintenance/Equipment Inquiry File

The preventive maintenance/equipment inquiry file is a cross-referenced listing of equipment by identification number and assigned preventive maintenance schedules.

To bring this file up on the screen, choose selection 02 from the preventive maintenance master menu. Next, key the equipment identification number onto the entry line. The selection process is repeated and the preventive maintenance listing of schedules performed on the piece of equipment appears **[Illustration 15]**. Appearing on the screen is the equipment identification number and description, schedule number, the last assigned job number for each schedule, a craft code identifying the craft performing the work on the schedule, frequency of compliance, and the last date on which the work was performed.

ILLUSTRATION 15
PREVENTIVE MAINTENANCE/
EQUIPMENT INQUIRY LISTING OF
MAINTENANCE SCHEDULES




Refer to the preventive maintenance/equipment file when updating the completed maintenance schedules. Enter compliance dates onto the last performed line of the schedules listed. The schedules are programmed to be printed at predetermined intervals before actually becoming due. This permits planning and scheduling at the shop level.

### ■ Preventive Maintenance Sequence

1. At scheduled intervals the computer scans the preventive maintenance/equipment inquiry file.

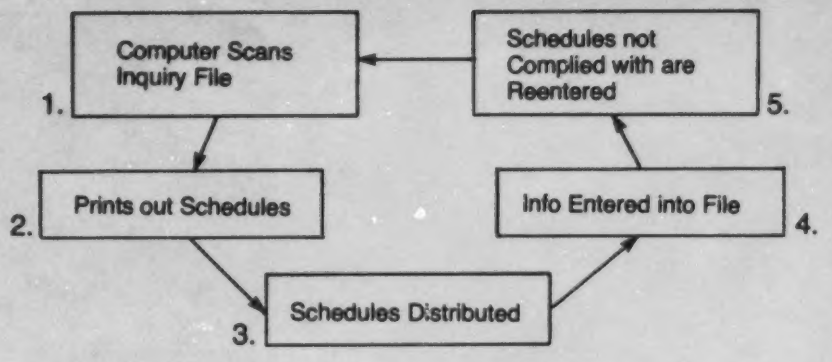
2. Computer prints out the maintenance schedules due for compliance and the time due.

3. The schedules are distributed to department heads who, in turn, have them completed by mechanics at the time due.

4. The schedules are signed off and forwarded to a terminal operator who enters the information into the preventive maintenance/equipment inquiry file.

5. Schedules due for compliance and not complied with automatically appear as overdue when the preventive maintenance program is run for the next period.

ILLUSTRATION 16
PREVENTIVE MAINTENANCE
SEQUENCE




## Selection 05 — Maintenance Forecast

All scheduled maintenance entered into the maintenance system is controlled by the maintenance forecast program. The program generates work orders at the next date you have scheduled for compliance.

Scheduled maintenance is divided into three classifications to simplify planning and scheduling at the shop level. The classifications are:

- **Dispatch work order** — Follow-up work orders derived from the dispatch maintenance system
- **Preventive maintenance work orders** — Equipment preventive maintenance servicing
- **Elective work orders** — Work requested by the campus community or planned by the physical plant department

When printed, work orders are distinguished by the letters DW, PM, or EW. Accompanying the printed work orders is a work order summary which lists the work orders by job number and order of urgency. The summary report depicted in **Illustration 17** is used as a management tool and to note work order assignments. Work order job numbers are printed in sequence of urgency by date. Therefore, overdue work orders will appear first.

ILLUSTRATION 17
MAINTENANCE FORECAST
REPORT

MAINTENANCE FORECAST REPORT

REPORT DATE 08-15-83

| JOB # | TOLERANCE | DUE AT | CRAFT | CLASS. | ASSIGNED TO | DATE | COMPLETION DATE |
|---|---|---|---|---|---|---|---|
| 4309 | +10 | 07-12-83 | 03 | EM | | | |
| 5406 | + 7 | 08-22-83 | 07 | PM | | | |
| 5407 | +11 | 08-26-83 | 07 | PM | | | |
| 5439 | +20 | 09-04-83 | 02 | DM | | | |

To generate scheduled work orders, the maintenance forecast master in **Illustration 18** is brought up on the screen. There are four options to choose from. The appropriate option is entered on the line and the command key depressed. The work orders and work order summary automatically prints.

ILLUSTRATION 18
MAINTENANCE FORECAST MENU

### ■ Tolerance Planning

To provide for sufficient scheduling at the shop level, work orders must be generated and distributed before they are actually due. For instance, if a work order is scheduled for the 15th of the month, it should be printed by the computer and given to the appropriate shop at least a week in advance. This capability must be programmed into the software of the maintenance forecast program.

There are two alternatives to accomplishing this: **built-in tolerance** or **predetermined tolerance**. With the built-in tolerance the software is programmed to generate all work orders at a set number of days before coming due. The predetermined tolerance permits any tolerance to be entered into the work order system when the work order is created. The benefit of a flexible tolerance is that lead time can be established for each work order based upon complexity of the task and other scheduling commitments.

A tolerance can also be programmed to act as a buffer between the date a work order is due and when it will appear on the backlog. A closed end tolerance permits a range of compliance time. This is the period between the date received and the date it appears as overdue.

## Selection 06 — Deferred Maintenance

The deferred maintenance master program is used to store information relative to the aspects of deferred maintenance and capital equipment lifecycling. Deferred maintenance is defined as a needed repair or restoration that cannot be undertaken because funds are not available. Capital lifecycling is defined as the anticipated renewal or replacement of equipment and building components at the expiration of the lifecycle.

### ■ Deferred Maintenance

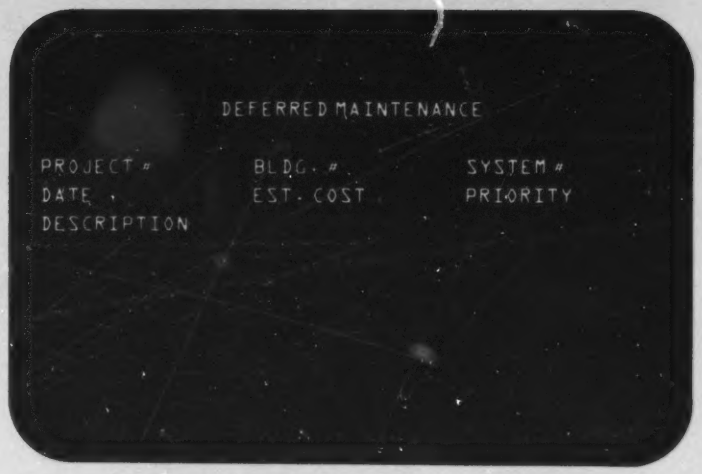
To establish a record of deferred maintenance, you must inspect the campus for needed repairs or restorations, which are entered into a deferred maintenance file. This is accomplished by bringing up the deferred maintenance master on the screen.

DEFERRED MAINTENANCE MASTER MENU

01 Deferred Maintenance
02 Capital Lifecycle Replacement
Enter Selection _____

Enter the deferred maintenance option number on the selection line and the screen format in **Illustration 19** will appear. Deferred maintenance items are then entered into the file.

ILLUSTRATION 19
DEFERRED MAINTENANCE
PROJECT ENTRY



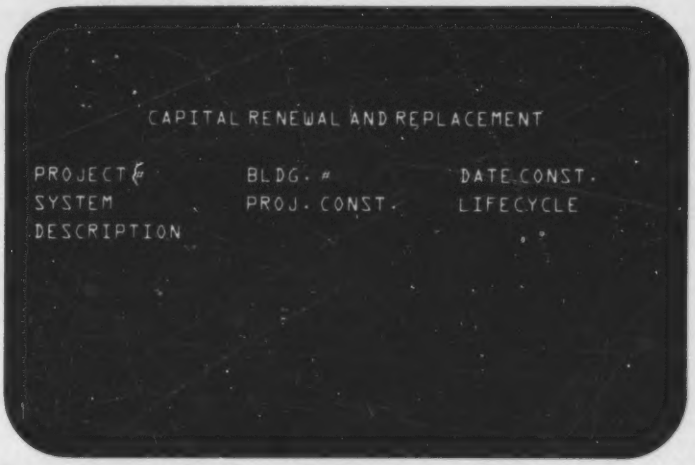

A cost escalation factor can also be programmed into the deferred maintenance system. It would provide three costs—the repair or restoration cost at the time the task was designated as deferred and entered into the system, escalated cost to date, and a twelve month projected cost.

■ **Capital Lifecycle Replacement**

The capital lifecycle replacement system is similar to the deferred maintenance system in that it contains information about expenditures required to maintain the integrity of a facility. However, "deferred" generally implies that a condition exists and funds are not available. Lifecycle replacement, on the other hand, implies that funding for future replacement of building components must be anticipated.

A capital renewal or replacement file is created to contain lifecycle data [**Illustration 20**]. Each lifecycle replacement entry is given a project number for identification purposes. The project number is designed to identify each building and the systems and building components.

ILLUSTRATION 20
LIFECYCLE PROJECT ENTRY




This enables lifecycle projects to be summarized by specific characteristics. For instance, project number 100-046-0088 would indicate that the roof (100) on building 046 will achieve lifecycle maturity in 1988. If you must know which roofs will achieve lifecycle maturity in the next 60 months, enter the roof component number with the appropriate option number. The option numbers 01 and 05 represent projected lifecycle maturity time periods. If a system or component number is not entered with the option number, all projects coming due within the time period will print. This feature is called a report generator and can be

expanded to generate lifecycle information by building number and maturity date.

ILLUSTRATION 21
CAPITAL
RENEWAL/REPLACEMENT
REPORT

**CAPITAL RENEWAL/REPLACEMENT REPORT**

**03: PRINT ALL PROJECTS DUE IN 120 MO. SYSTEM: ROOFS**
**FROM: 08-01-82 THRU 08-01-92**

| SYSTEM # | PROJECT # | BUILDING # | LIFECYCLE | EXPIRATION | PROJECTED COST |
|---|---|---|---|---|---|
| 100 | 0460068 | 046 | 20 YRS | 10-09-88 | 620,000 |
| 100 | 0830090 | 083 | 25 YRS | 04-12-90 | 340,000 |
| 100 | 0840091 | 084 | 25 YRS | 06-01-91 | 340,000 |
| 100 | 0860091 | 086 | 20 YRS | 09-10-91 | 20,000 |
| | | | | | TOTAL $1,320,000 |

The groundskeeping service consists of four programs: zonal turf management master, equipment master, equipment P.M. master, and work order. If warranted, the programs can be integrated into one master system along with the facility maintenance service. However, in this application the system is a stand-alone or independent system that functions by itself. ■

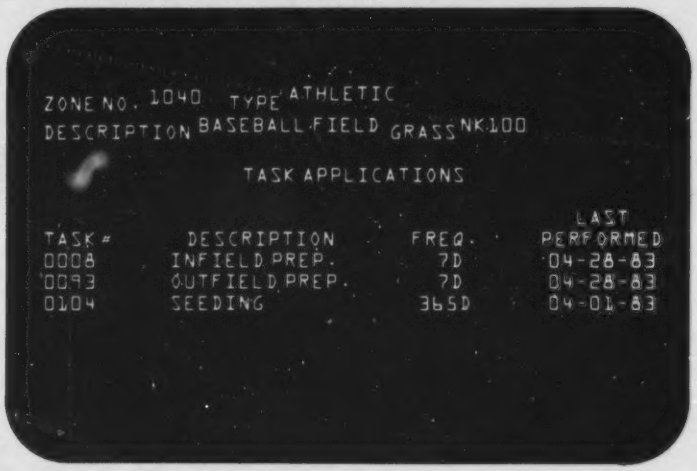
## Selection 01 — Zonal Turf Management Program

The zonal turf management program is a zonal breakdown of turfed areas throughout the campus. Zones are determined by usage, groundskeeping requirements, or location. Zonal management provides for improved aesthetics and better utilization of labor and equipment.
The zonal turf management master is representative of a campus divided into three types of zones — academic, residential, and athletic. The zones or files contain application and groundskeeping information for each zone. To implement the program, divide the campus into zones and assign identification numbers to each. The zones are then inspected and an application and groundskeeping program written for each one.

ZONAL TURF MANAGEMENT MASTER

01 Academic Zones
02 Residential Zones
03 Athletic Zones
04 Grounds Task Master
05 Print Task Forecast
Enter Selection _____

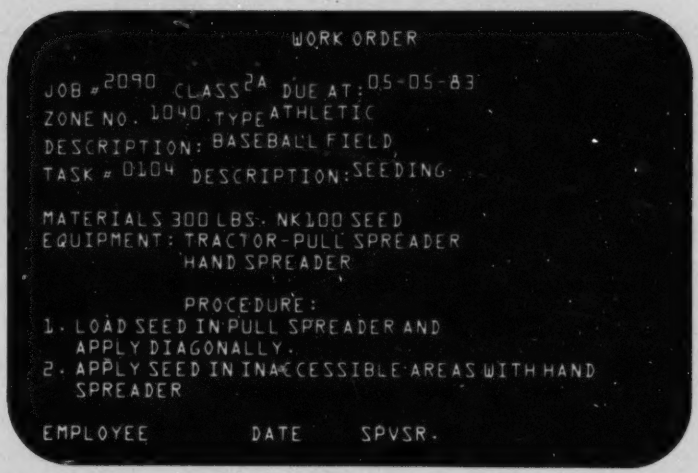
To enter application and groundskeeping data into the zonal turf master, the groundskeeping menu is brought up on the screen and the option for zonal turf management master is entered on the selection line. The zonal turf management master will then appear and the selection process is repeated. The academic zone file appears and the zone number is entered. A format for entering descriptive information about the zone appears on the screen [**Illustration 22**]. The information is keyed onto the screen and entered into the system, thus creating a library of groundskeeping zones.


ZONE NO. 1040 TYPE ATHLETIC
DESCRIPTION BASEBALL FIELD GRASS NK100
TASK APPLICATIONS
TASK # DESCRIPTION FREQ. LAST PERFORMED
0008 INFIELD PREP. 7D 04-28-83
0093 OUTFIELD PREP. 7D 04-28-83
0104 SEEDING 365D 04-01-83

### ■ Task Master File

The grounds task master file is the library of grounds tasks that are completed in various zones at predetermined frequencies. The application and groundskeeping procedures, written when the zones were established and inspected, are entered into the library as in **Illustration 22** above. The procedures are assigned zonal task numbers and are printed on zonal task work orders as they become due for compliance. **Illustration 23** shows the type of information found on a task card.

ILLUSTRATION 23
GROUNDSKEEPING WORK ORDER


WORK ORDER
JOB # 2090 CLASS 2A DUE AT: 05-05-83
ZONE NO. 1040 TYPE ATHLETIC
DESCRIPTION: BASEBALL FIELD
TASK # 0104 DESCRIPTION: SEEDING
MATERIALS 300 LBS. NK100 SEED
EQUIPMENT: TRACTOR-PULL SPREADER
HAND SPREADER
PROCEDURE:
1. LOAD SEED IN PULL SPREADER AND APPLY DIAGONALLY.
2. APPLY SEED IN INACCESSIBLE AREAS WITH HAND SPREADER
EMPLOYEE DATE SPVSR.

### ■ Task Forecast

The groundskeeping task forecast program prints out the grounds task application work orders as they become due for each zone. A summary report used to manage distribution and compliance is also printed. When the task application work orders are completed they are signed off. Completion data are entered into the appropriate zone file, thus updating the program. **Illustration 24** is representative of a groundskeeping task forecast report.

ILLUSTRATION 24
GROUNDSKEEPING TASK FORECAST

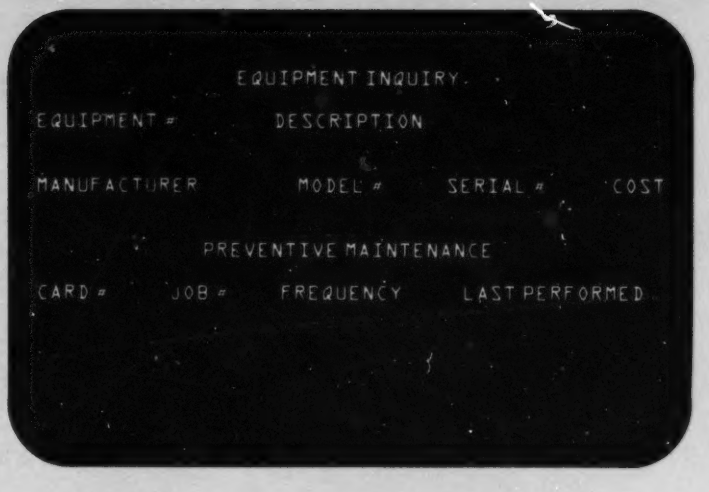
**GROUNDSKEEPING TASK FORECAST**

| Zone # 1197 | Type Athletic | | | |
|---|---|---|---|---|
| Task# | DESCRIPTION | DUE AT | ASSIGNED TO | RETURNED AT |
| 1052 | INFIELD PREP. | 05-16-83 | _____ | _____ |
| 1059 | SEEDING | 05-18-83 | _____ | _____ |
| Zone # 1202 | Type Residence | | | |
| 0804 | WEEDING | 05-16-83 | _____ | _____ |
| 0809 | PRUNING | 05-20-83 | _____ | _____ |

## Selection 02 — Equipment Master

The equipment master is an inventory of all equipment used by the grounds department. It contains three files — equipment inquiry, bill of materials inquiry, and equipment history. The equipment inquiry file contains pertinent information about each piece of equipment. **Illustration 25** depicts the kind of data that can be stored in the file; included are preventive maintenance tasks that are issued periodically.

ILLUSTRATION 25
EQUIPMENT INQUIRY



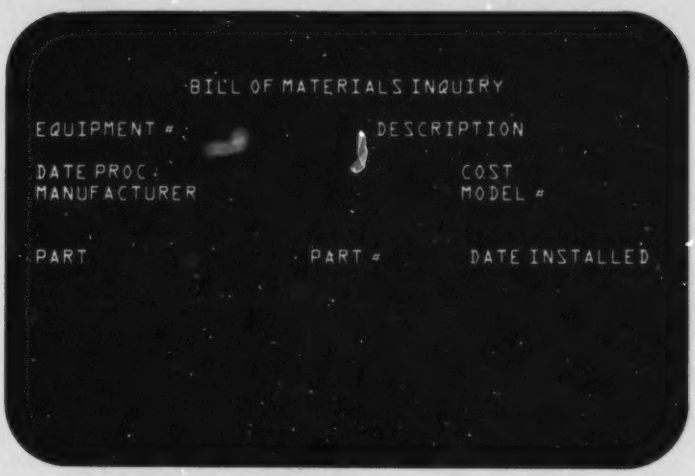

Generally, the equipment inquiry is used for powered and large nonpowered equipment requiring periodic maintenance. However, the file can also be used for hand tools and can serve as a record of inventory.

Filed data collection is a prerequisite to system operation. Each piece of equipment is assigned an identification number and pertinent information obtained from name plates. You can create a data collection form similar to the screen format in **Illustration 25** to ensure uniform data collection. Preventive maintenance card numbers will be assigned to the equipment after they are written. The equipment identification number and name plate data are entered into the equipment inquiry file, thus establishing a library of equipment.

### ■ Bill of Materials Inquiry

The bill of materials inquiry is a listing of parts and part numbers for each piece of equipment within the equipment inquiry file. The listing can consist of major components and recommended spares, or it can specify every part in detail. The inquiry serves as a record of parts replacement. **Illustration 26** shows the various information that can be found in the bill of materials inquiry file.

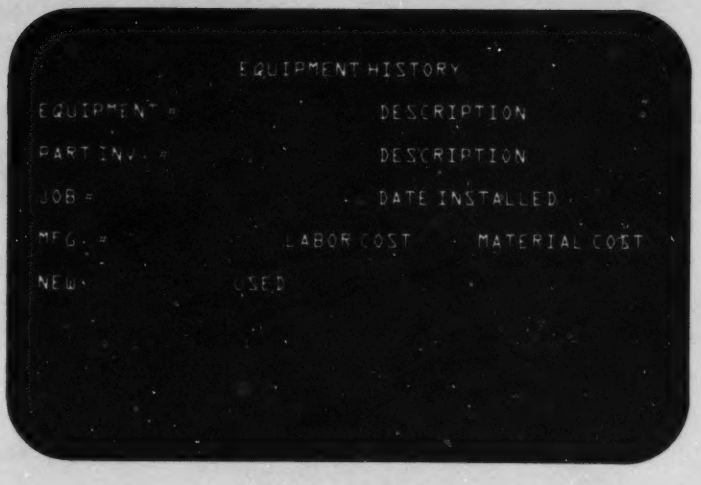
ILLUSTRATION 26
BILL OF MATERIALS INQUIRY




### ■ Equipment History

The equipment history file contains cumulative and chronological information relative to parts replacement and equipment servicing. Equipment maintenance work order information entered into the system is retained in the history file. **Illustration 27** depicts the type of information you can store in this file.

ILLUSTRATION 27
EQUIPMENT HISTORY



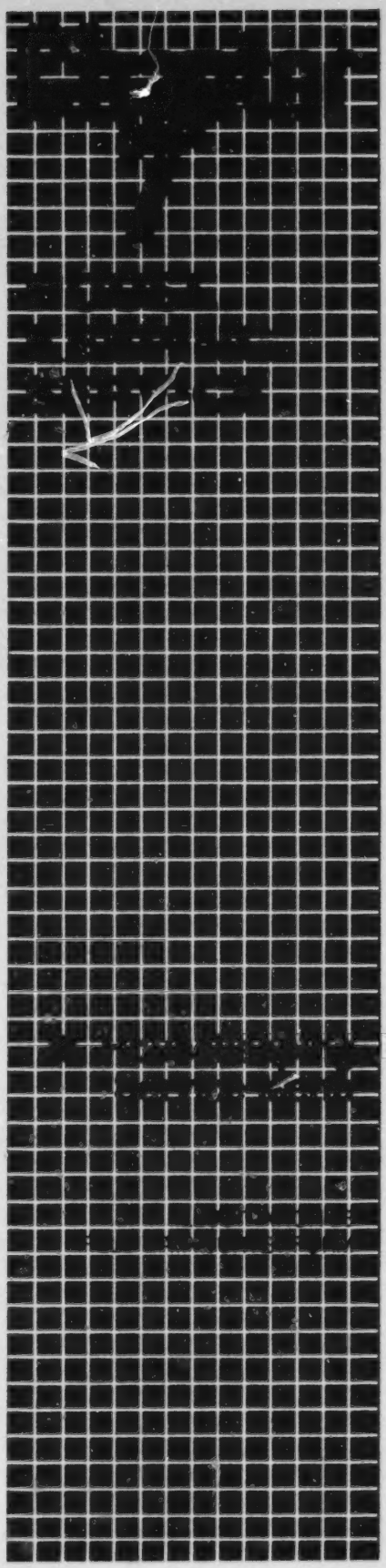

## Selection 03 — Equipment Preventive Maintenance Master

After you have entered the groundskeeping equipment information into the equipment inquiry file, you will then write preventive maintenance procedures for the program. Number and enter the procedures into a preventive maintenance master file or library. Refer to it when adding additional procedures or revising existing ones.

After the library is established, assign procedures to the equipment listed within the equipment inquiry file. At predetermined intervals based upon the frequencies established, the computer will print the procedures onto work orders. When the work orders are completed, you will update the program by entering the information into the system. Work orders that are not completed on schedule will appear as overdue or reserved for the next period.

## Selection 04 — Work Order

The groundskeeping work order system is used to plan scheduled and elective groundskeeping functions including preventive maintenance. All scheduled events such as equipment maintenance and zonal groundskeeping applications are printed on the work orders by the computer. Elective groundskeeping requirements such as requests made by the campus community are entered into the work order system with a scheduled date of service. Those work orders will print out just before becoming due. ■



The housekeeping system is designed to analyze cleaning tasks and project labor requirements. This is accomplished with a software system that is programmed to retain cleaning time specifications for every kind of cleaning operation. For instance, when a cleaning operation for a type of desk or a quantity of desks is input into the system, the computer responds by calculating the cleaning time. This may appear to be a relatively simple function to develop without a computer, but a campus cleaning operation consists of many time requirement variables that are continuously changing. As cleaning requirements throughout the campus change — based on fluctuations in furnishings and changes in cleaning surfaces — the data are input into the system and labor requirements are revised to meet the changes.

The purpose of the computerized housekeeping system is threefold.

1. To identify and inventory all cleaning tasks throughout the campus.

2. To establish a housekeeping program that clearly outlines the cleaning needs of the campus and provides for maximum utilization of the housekeeping work force.

3. To easily revise cleaning operations and time specifications as conditions warrant.

The housekeeping service menu lists the three programs designed to equalize cleaning operations, monitor labor availability, and analyze cleaning requirements on a continuous basis. ■

HOUSEKEEPING SERVICE MASTER MENU

| | |
|---|---|
| 01 Building Master | 03 Workloading Matrix |
| 02 Task Library | Enter Selection _____ |

## Selection 01 — Building Master

The building master program is the data bank of furnishings and dimensions of all areas within each building. The data are obtained by surveying each building and entering the information into the building master file. The form in **Illustration 28** is used to uniformly record survey data.

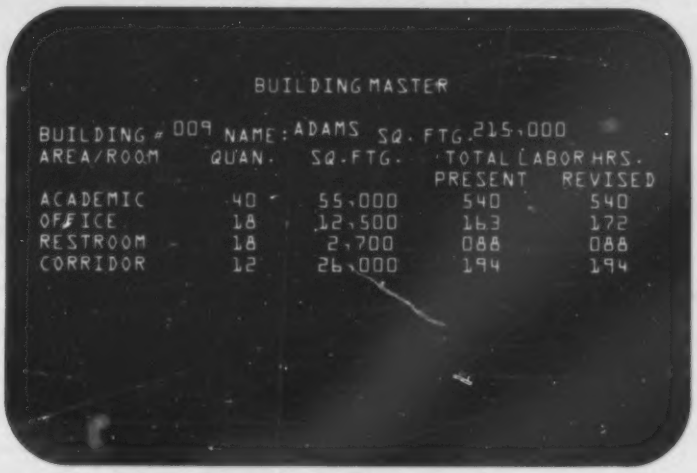
FIELD DATA SURVEY

BUILDING # _____ FLOOR _____ AREA/ROOM _____

| DIMENSIONS: WIDTH | LENGTH | HEIGHT | |
|---|---|---|---|
| 0001. WASTE RECEPTACLE | | QUANTITY _____ | TYPE _____ |
| 0002. WINDOW | | QUANTITY _____ | TYPE _____ |
| 0003. DOOR | | QUANTITY _____ | TYPE _____ |
| 0004. LIGHT FIXTURE | | QUANTITY _____ | TYPE _____ |
| 0005. CEILING | | QUANTITY _____ | TYPE _____ |
| 0006. WALL | | QUANTITY _____ | TYPE _____ |
| 0007. FLOOR | | QUANTITY _____ | TYPE _____ |
| 0008. DESK | | QUANTITY _____ | TYPE _____ |
| 0009. CHAIR | | QUANTITY _____ | TYPE _____ |
| 0010. SUN SCREEN | | QUANTITY _____ | TYPE _____ |

When you have entered all survey data into the file, the computer generates a summary of labor hours for various areas [**Illustration 29**]. At the top of the screen the building number and name are listed with the total square footage. In the Area/Room column are four categories of rooms and areas found in the building. Categories can be expanded as required. The Quantity column identifies the quantity of rooms/areas for each space category. And the Square Footage column contains the square footage total for each space category.

ILLUSTRATION 29
BUILDING MASTER FILE

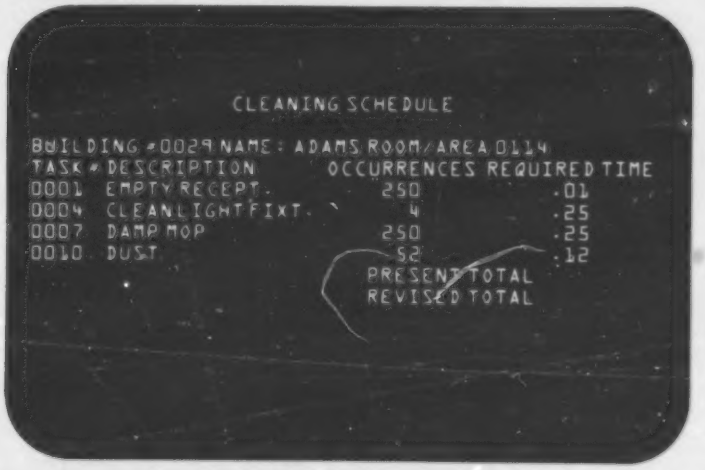

BUILDING MASTER
BUILDING # 009 NAME: ADAMS SQ. FTG. 215,000
AREA/ROOM QUAN. SQ. FTG. TOTAL LABOR HRS.
PRESENT REVISED
ACADEMIC 40 55,000 540 540
OFFICE 18 12,500 163 172
RESTROOM 18 2,700 088 088
CORRIDOR 12 26,000 194 194

The Annual Labor columns are for annual labor requirements of each space category. The Present column lists present labor requirements as of the most recent updating of the building master file. When you periodically update the file by inputing revised survey information, revised labor requirements, if any, will appear. For example, there are 18 office spaces totaling 12,500 square feet of space and requiring 163 hours of labor to maintain. The next annual survey indicates that 172 hours of labor are required to maintain the spaces. Further examination finds that an increase of furniture and the addition of window draperies has affected the change in cleaning labor. Cleaning operations can then be revised to include these items. Cleaning operations listed by room/area are detailed in the task library file.

## Selection 02 — Task Library

The task library is a listing of cleaning operations being performed throughout the campus. When a revision to the cleaning operation of a specific area is required, the task library is brought up on the screen. The building number and room/area identification number are entered and the cleaning schedule for the area appears [**Illustration 30**].

ILLUSTRATION 30
AREA CLEANING SCHEDULE


CLEANING SCHEDULE
BUILDING #0029 NAME: ADAMS ROOM/AREA 0114
TASK # DESCRIPTION OCCURRENCES REQUIRED TIME
0001 EMPTY RECEPT. 250 .01
0004 CLEAN LIGHT FIXT. 4 .25
0007 DAMP MOP 250 .25
0010 DUST 52 .12
PRESENT TOTAL
REVISED TOTAL

The cleaning schedule identifies all cleaning operations performed in the area, frequency of occurrence, and estimated completion time per occurrence. Upon entering revised data into the file for Room 0114, the cleaning schedule is revised. A comparison of present labor and revised labor can be made before the new labor requirements are integrated into the schedule. The comparison provides for the redistribution of labor, if necessary.

## Selection 03 — Workloading Matrix

Up to this point all cleaning operations have been identified in addition to the total labor hours required to perform them. We arrive at this by inputing field survey data into the building master file. Generally, when we compare the labor hours required to perform all tasks with the labor hours available, we find that there are more housekeeping requirements than personnel.

The alternatives to performing all housekeeping operations are to hire more housekeepers or proportionately reduce the occurrences of each operation. The latter is accomplished with the workloading matrix.

To bring the occurrences of each housekeeping operation in-line with available labor hours, the occurrences are reduced by revising the frequency of occurrences. For instance, a housekeeping operation performed twelve times annually is changed to eight times per year, and performed every 45 days instead of every 30 days.

ILLUSTRATION 31
WORKLOADING MATRIX MASTER

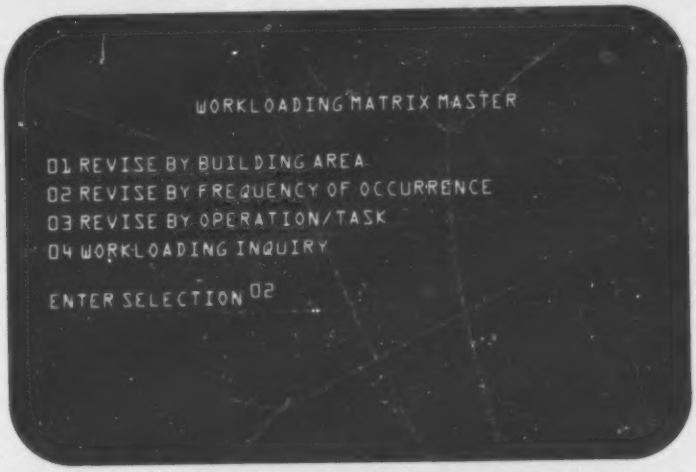
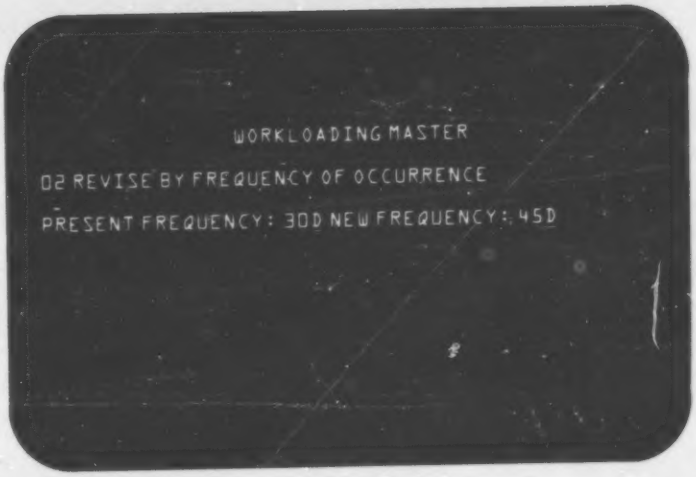
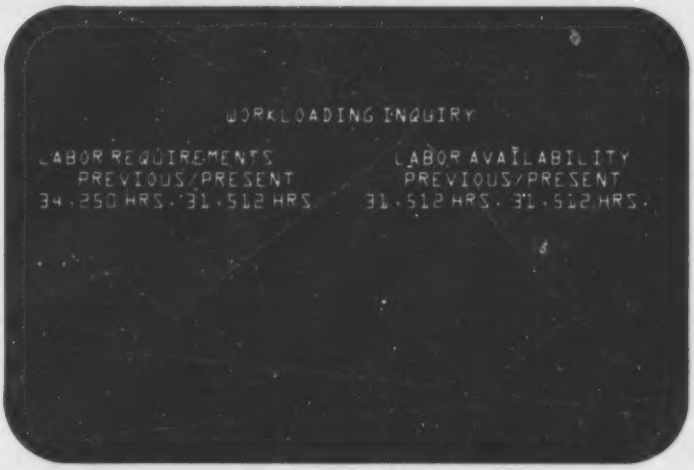

WORKLOADING MATRIX MASTER
01 REVISE BY BUILDING AREA
02 REVISE BY FREQUENCY OF OCCURRENCE
03 REVISE BY OPERATION/TASK
04 WORKLOADING INQUIRY
ENTER SELECTION 02

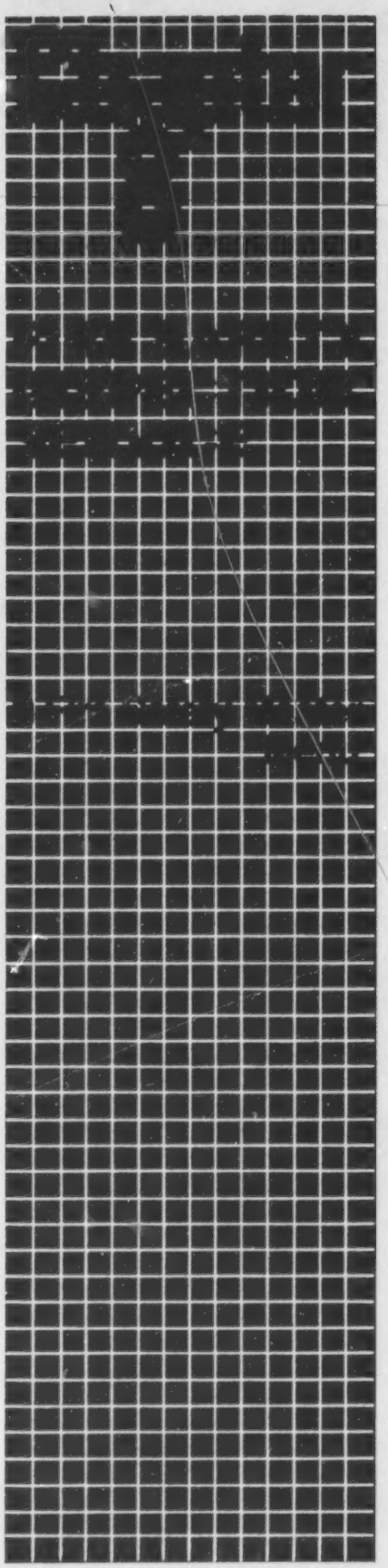
ILLUSTRATION 32
REVISING FREQUENCY OF
OCCURRENCE



The workloading matrix is brought up on the screen and the revision by occurrence option is selected [**Illustration 31**]. Then the workloading master appears and allows you to revise the frequency of occurrence [**Illustration 32**]. Finally, the workloading matrix inquiry is brought up on the screen to verify the revision you have made [**Illustration 33**]. The labor requirements of the housekeeping program are now equivalent to available labor hours. ■

ILLUSTRATION 33
WORKLOADING INQUIRY





The fire safety inspection system is used to manage the servicing requirements of fire extinguishing equipment, conduct fire safety inspections, and monitor the compliance of citations. The system consists of three programs. ■

FIRE SAFETY MASTER MENU

01 Fire Stations
02 Fire Safety Inspections
03 Fire Safety Citations
Enter Selection _____

## Selection 01 — Fire Stations

The fire stations program identifies the location of each fire station, the kinds of equipment at the station, and the dates equipment is serviced. A fire station is defined as the location of a fire extinguisher, hose reel, pump room, control valve, or any other fire safety equipment.

To access the fire stations program, enter option 01 from the fire safety master menu onto the selection line and depress the command key. The fire station menu will then appear. The fire stations program consists of two files — station inventory and service/station master — and a print forecasting program that prints out a list of fire stations in need of scheduled servicing. This would include weight checks, hydrostatic checks, and the replacement of consummables and life-limited items.

### ■ Station Inventory

The station inventory file contains the locations of each fire station and the inventory of equipment at the station. To implement the program, first number and inventory all fire safety equipment locations. These data are entered into a station inventory file. Developing the station inventory is a prerequisite to servicing the equipment. The computer must know the location of the station and the equipment complement before it can print out the services that must be performed on the fire safety equipment at each station.

### ■ Service/Station Master

The service/station file contains the services that will be performed on the fire safety equipment at each station, frequency of compliance, and the last date serviced. Through formulated programming the computer scans this file and prints out the fire stations requiring service and the service to be rendered [**Illustration 34**]. When your department has completed the services, enter the compliance data into the file under the appropriate station. This action updates the program.

ILLUSTRATION 34
SERVICE/STATION FILE

### ■ Print Station Services

Periodically, the computer prints (onto fire station service cards) the services to be performed on the fire safety equipment. The cards identify the equipment at the station requiring service and are distributed to personnel for compliance. The cards are signed off when completed and are then returned to a terminal operator who inputs the data into the service/station file. **Illustration 35** is representative of a fire station service card.

ILLUSTRATION 35
FIRE STATION SERVICE CARD

FIRE SERVICE/STATION CARD

STATION # 147918 BUILDING # 32 FLOOR/LOCATION 3-E CORRIDOR
SERVICE WT. CHECK FIRE BOTTLE S/N L5488 DUE DATE: 8-22-83
WT. CHECK FIRE BOTTLE S/N L5963 DUE DATE: 8-22-83
SERVICED BY _____ DATE _____

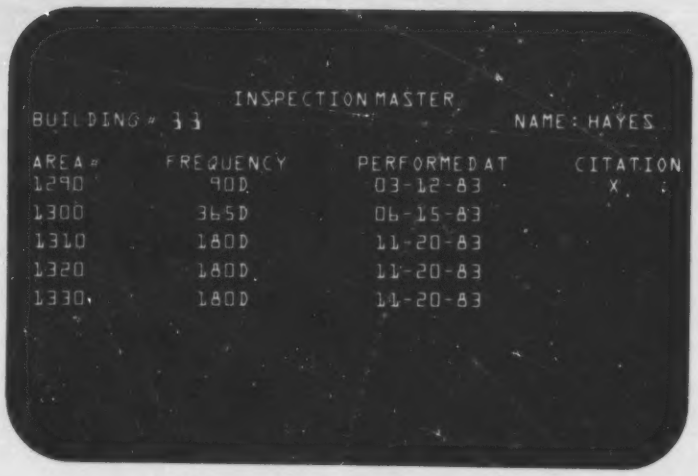
## Selection 02 — Fire Safety Inspections

The fire safety inspection program provides for continuous inspection of campus facilities exclusive of fire stations. If warranted, the fire safety inspection program can be combined with the fire stations inspection program. This is determined by the number of items managed in each function.

### ■ Inspection Master File

The fire safety inspection program consists of a master file containing areas of the campus to be inspected for fire safety violations. To implement the program, conduct a field survey of the campus and number the areas to be inspected. Enter into the inspection master file these areas and the frequency at which the inspection is performed [**Illustration 36**].

ILLUSTRATION 36
INSPECTION MASTER FILE




■ **Print Fire Safety Inspections**

The print fire safety inspections program performs the same function as the print station services program. As inspections fall within a range of becoming due for compliance, the computer prints them on fire safety inspection cards. The cards are distributed to personnel who perform the inspections, sign them off when completed, and return them to a terminal operator who updates the program by entering the information into the inspection master file [**Illustration 37**].

ILLUSTRATION 37
FIRE SAFETY INSPECTION CARD

FIRE SAFETY INSPECTION

BUILDING # 84 AREA # 1-3307 DUE DATE 8-22-83
DESCRIPTION NORTH STAIRWELL STORAGE AREA UNDER STAIR
INSPECTED BY _____ DATE _____
CITATION ISSUED _____ CITATION NUMBER _____

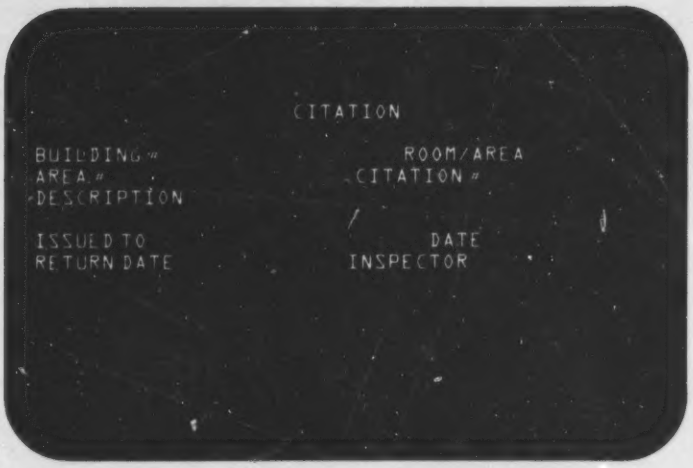
## Selection 03 — Fire Safety Citations

In the course of performing fire safety inspections, violations of fire codes are recorded on citations and are given to the space occupant for corrective action. The fire safety citation program permits tracking of issued citations.

The citation program appears on the screen and consists of three options: 01 — Enter Citation; 02 — Citation Status; and 03 — Print Outstanding Citations.

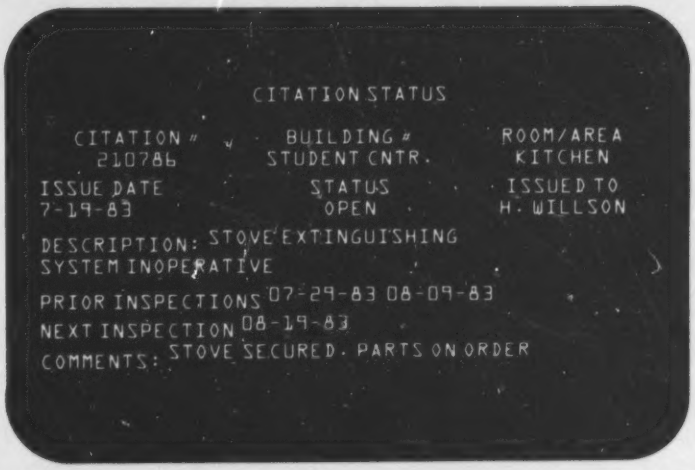
Enter option 01 onto the selection line when you wish to enter a citation. The screen format in **Illustration 38** will appear and you will key the citation information onto the screen. Also enter a return date. If the citation has not been corrected by the return date, it will print out on the outstanding citation report as overdue.

ILLUSTRATION 38
CITATION




The citation status inquiry is a record of all issued citations and their statuses. Because a citation may require a long period of time to resolve, the inquiry file permits continuity in the system [**Illustration 39**].

ILLUSTRATION 39
CITATION INQUIRY




■ **Outstanding Citations**

On a timely basis the computer prints an outstanding citation summary report. The report contains all citations that were not corrected before the return date. Physical plant personnel will make a follow-up inspection of the area and remind the occupant that he or she is not in compliance and that a reasonable amount of time has passed since the citation was first issued. See an example of the outstanding citation report in **Illustration 40.** ■

ILLUSTRATION 40
OUTSTANDING CITATION REPORT

**OUTSTANDING CITATION REPORT**

CITATION # 3922 BUILDING # 12 ROOM/AREA 212
ISSUED BY S. TOYLE ISSUE DATE 9-15-83 ISSUED TO W. HOLLY
FOLLOW-UP DATES 9-27-83 / 10-15-83 / _____ / _____
DESCRIPTION FLAMMABLE LIQUID NOT STORED IN REGULATION CONTAINER.

---

CITATION # 3957 BUILDING # 33 ROOM/AREA 2D
ISSUED BY W. HILL ISSUE DATE 8-04-82 ISSUED TO J. STEINERT
FOLLOW-UP DATES 8-20-82 / 9-10-82 / 9-26-82 / _____
DESCRIPTION ACCUMULATION OF RAGS UNDER STAIRWELL

The vehicle maintenance system is used to schedule service, monitor fuel consumption, and regulate vehicle replacement. The system is capable of controlling all types of motor vehicles. It consists of the six programs listed below. To access a program, enter the option number onto the selection line. Depress the command key and the program will appear on the screen. ■

VEHICLE MAINTENANCE MASTER MENU

01 Vehicle Inquiry
02 Fuel/Oil Consumption
03 Lifecycle Forecast
04 P.M. Library
05 Vehicle/P.M. Reference
06 P.M. Forecast
Enter Selection _____

## Selection 01 — Vehicle Inquiry

The vehicle inquiry file contains pertinent information about each vehicle maintained in the system. To access information about a specific vehicle, enter the vehicle identification number onto the screen. Repeat the selection process and the vehicle information appears on the screen [**Illustration 41**].

## Selection 02 — Fuel/Oil Consumption

The fuel/oil consumption program is used to manage fuel and oil distribution and pinpoint excessive consumption. High fuel consumption indicates, among other things, that a maintenance check is in order.

When a vehicle is fueled, record the quantity, mileage, and date on a fuel requisition form. Then enter all the data into the fuel/oil consumption system. The computer will periodically generate a fuel/oil consumption summary for you to review. Consumption information can be grouped by vehicle, date, calendar period, or driver.

## Selection 03 — Lifecycle Forecast

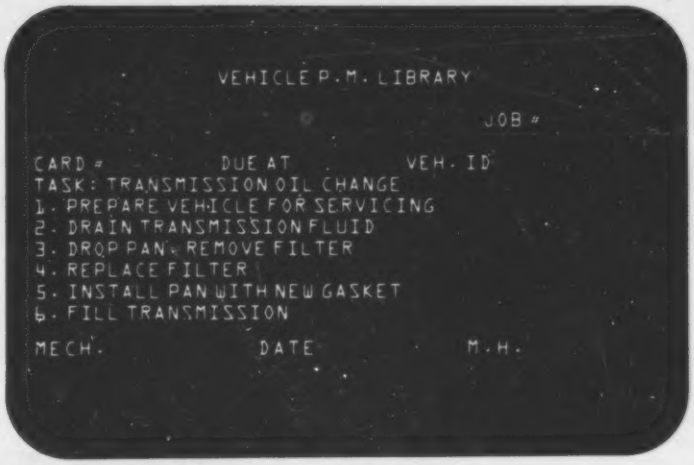
The lifecycle forecast permits timely replacement of motor vehicles. The physical plant administrator's decision on vehicle replacement is based upon age, accumulated mileage, condition, and the dollar value of parts replaced on each vehicle. The computer is programmed to indicate when any of the predetermined factors are reached. Vehicle data are entered into the system and cumulatively retained by the computer.

The computer prints a lifecycle maturity notice when the present date, accumulated mileage, or total dollar value expended for parts for a particular vehicle meets or exceeds the pre-established totals on record in the lifecycle forecast file. The lifecycle forecasting system is designed to obtain maximum utilization at a reasonable cost.

## Selections 04, 05, & 06 — Preventive Maintenance Servicing

Periodic vehicle servicing is accomplished by means of a library of unique vehicle maintenance procedures. The procedures are entered into the library and identified by a unique number. The procedures are then assigned to applicable vehicles and are programmed to be printed by the computer as they become due for compliance. Frequency of compliance can be by miles, in calendar time, or a combination of both. **Illustration 42** is representative of a vehicle maintenance procedure on file in the maintenance library.

ILLUSTRATION 42
VEHICLE P.M. LIBRARY




To generate a forecast of vehicles requiring service, select option 06 from the vehicle maintenance menu. The P.M. forecast software is programmed to scan the vehicle/P.M. master file [**Illustration 43**] and print out a summary listing of vehicles requiring service, type of service, and the service identification number [**Illustration 44**]. Another software program then prints the service procedures onto work orders and includes the vehicle identification number and the time the service is to be performed.

ILLUSTRATION 43
VEHICLE/P.M. MASTER

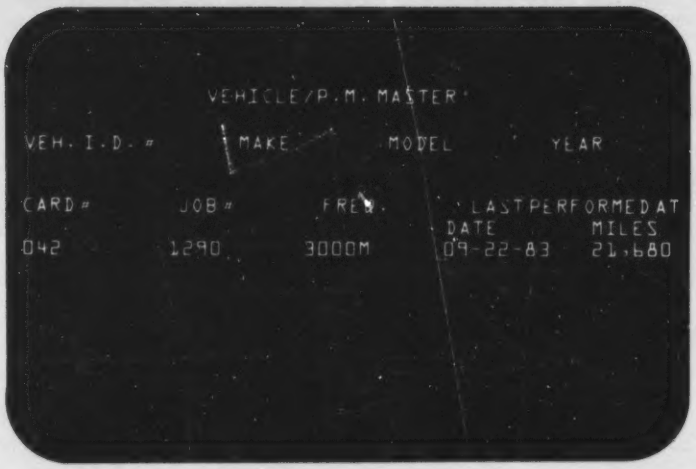



ILLUSTRATION 44
VEHICLE FORECAST REPORT

**VEHICLE FORECAST REPORT**

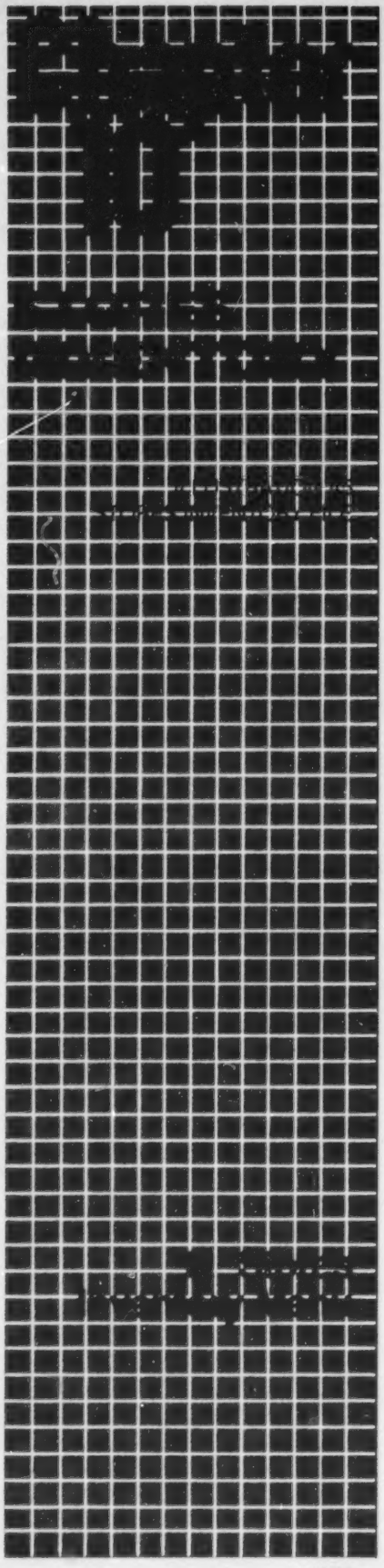
VEHICLE ID. # 239860 MAKE CHEV. MODEL SEDAN

| JOB # | CARD # | TASK DESCRIPTION | DUE AT | ASSIGNED TO |
|---|---|---|---|---|
| 3140 | 0142 | SAFETY INSPECTION | 04-07-83 | |
| 3141 | 0862 | CHASSIS LUBE. | 04-21-83 | |

VEHICLE ID. # 300422 MAKE PLYM. MODEL SEDAN

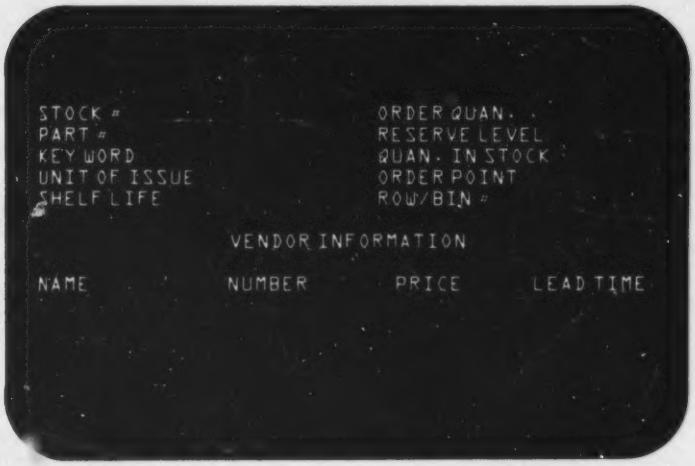
| | | | | |
|---|---|---|---|---|
| 3142 | 0142 | SAFETY INSPECTION | 04-04-83 | |
| 3143 | 0099 | REMOVE SNOW TIRES | 04-01-83 | |
| 3144 | 0106 | ENGINE TUNE-UP | 04-11-84 | |

All other servicing, be it breakdown or elective, is planned and scheduled on work orders, which are entered into a work order system. The computer prints out the work order when a job is due for compliance. After staff members have serviced the vehicle, the information on the job is entered into the system and the cycle is completed. ■



The stores inventory system is utilized by all trades within the physical plant department. It is used to maintain sufficient stock levels of consummables and spare parts.

The system is implemented by developing a stores entry format that is used to record descriptive information about each stock item. **Illustration 45** depicts the information contained in the stores inventory system.




A prerequisite to implementation is the organization of stores. Group your department's materials by likeness and contain them in areas that are numerically identified. Small items can be stored in bins while large items, such as concrete blocks, can be stored in bays. Next, take an inventory of stores and record the data on a form similar to the format shown in **Illustration 45** above. Finally, input the data into the system. This creates the inventory master file. ■

STORES INVENTORY MASTER MENU

01 Stores Inventory Master
02 Order Processing
03 Utilization Analysis
Enter Selection _____

## Selection 01 — Stores Inventory Master

The stores inventory master contains the status of all stock items. Modification of the inventory — adding, revising, or deleting items — is done through the inventory master file. A stock item can be brought up on the screen by means of the stock number, part number, or key word. The status information your department has compiled will then appear on the screen as in **Illustration 45.**

Unit of Issue indicates the standard quantity issued per request. Order Quantity is the quantity ordered for restocking. Reserve Level is the quantity of stock items reserved for scheduled work orders that have yet to be executed. Quantity in Stock is the quantity available less the reserve level. Order Point is the

minimum quantity on hand at which time to reorder. Row/Bin Number is the location of the item. Vendor Information identifies the supplier, last purchase price, and lead time after placing the order.

When ordered stock is received it is entered into the system with the stock number, quantity received, unit price, and vendor number.

## Selection 02 — Order Processing

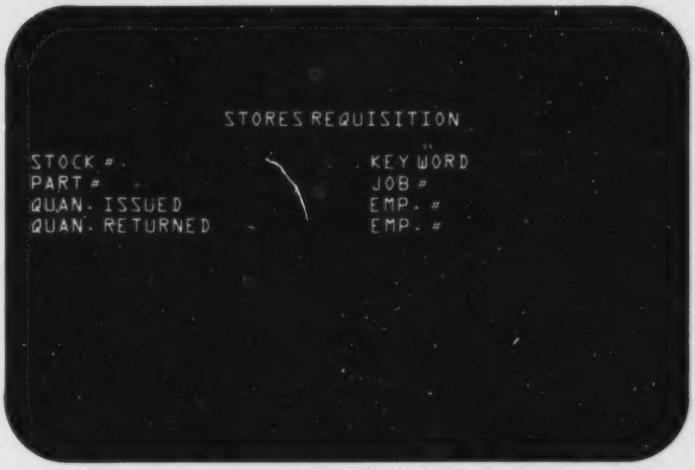
The order processing system monitors the distribution of stores, quantity in stock, the minimum and maximum status, and the status of stock items with a shelf life.

### ■ Stores Requisition

A stock withdrawal begins by submitting a requisition. The requisition generally identifies the item by part number and key word. Stores personnel then validate the requisition by means of the stores inventory master and verify quantity on hand and location within the system.

The stock number, part number, job number, quantity issued, and employee number are then entered into a requisition file [**Illustration 46**]. The requisitioned stores are issued or reserved for future use. In the stores master file the quantity on hand is automatically adjusted reflecting the new quantity available.

ILLUSTRATION 46
STORES REQUISITION



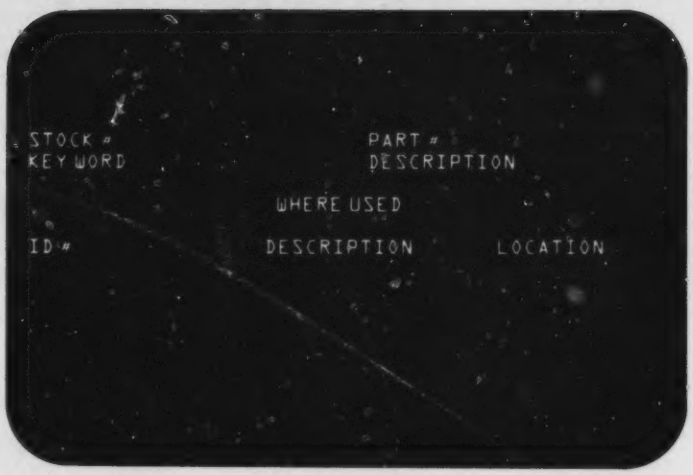

An advanced method of stores requisition permits work order planners to access the system, plan work orders, draw stores, and automatically update inventory levels by using a terminal. At the time the work order becomes due the store requisition would print out at the warehouse and personnel would prepare the order for pickup or delivery.

### ■ Where Used Inquiry

The "where used" inquiry file contains descriptive information on a part's usage. "Where used" information is helpful in establishing stock levels based upon quantity of like parts currently in use. It is also called upon in emergencies when a replacement part must be taken from a piece of equipment.

When you select the "where used" option of the order processing menu, a new format appears and you will enter the part number, stock number, or key word into the system. Depress the command key and the part in question appears on the screen [**Illustration 47**].

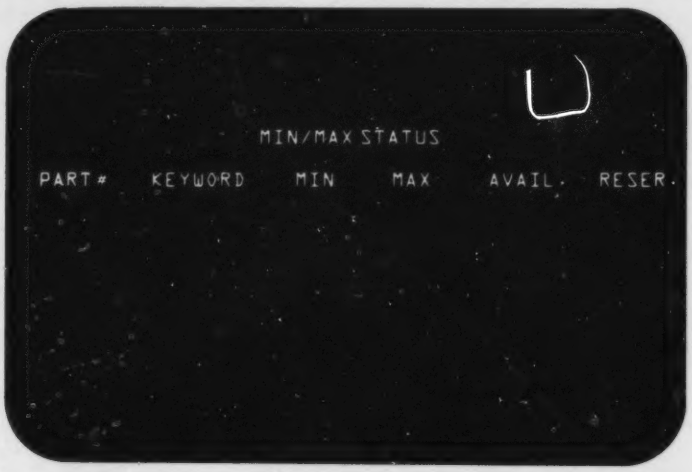
ILLUSTRATION 47
WHERE USED INQUIRY




### ■ Min/Max Status

The min/max status program is a notification of stock items that have lowered in quantity to a pre-established reorder point. A summary report can be printed weekly, or individual stock notices can be printed at the time the stock item reaches a minimal level. **Illustration 48** shows the information contained in the min/max status file.

ILLUSTRATION 48
MIN/MAX STATUS



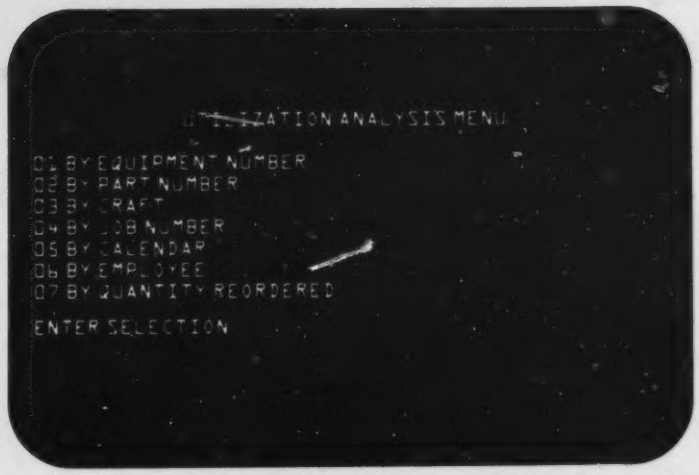

### ■ Shelf Life Status

The shelf life status program identifies stock items that have exceeded shelf life before being used. Such life-limited products include rubber gaskets, adhesives, paint, and chemicals. If a stores item has a shelf life, enter that information into the stores inventory master and it will then be controlled by the date specified on the stock. For example, a set of pump gaskets with a 24-month shelf life is entered into stock on 2/15/84. When entered into the system and stored in a bin, the gaskets are tagged with the order number. Just prior to 2/15/86, the gaskets will appear by order number on the shelf life expiration report.

## Selection 03 — Utilization Analysis

The utilization analysis is used to monitor parts life, pilferage, and stores inventory budget. Stock utilization information can be generated by the computer in seven variations [**Illustration 49**].

ILLUSTRATION 49
UTILIZATION ANALYSIS MENU




A utilization history by equipment number can indicate excessive parts replacement on certain equipment. Utilization by part number can indicate quality or performance. Utilization by trade can indicate that overall utilization is not excessive. Utilization by job number enables the charging of various campus cost centers. Utilization by calendar provides for budget monitoring. Utilization by employee ensures that the appropriate trade is using necessary stock items. And finally, utilization by quantities reordered monitors budget expenditures and summarizes utilization. ■

# APPENDIX A

# Computerized Functions at College and University Physical Plants

This section comprises an alphabetical listing of nearly 400 college and university physical plants that have computerized one or more of their technical and administrative operations. APPA conducted this survey of all member-institutions in Spring 1983 and will update the data in future publications.

The tables that follow include the name and address of each responding institution, name and telephone number of the contact person, name and model of the hardware involved, and a list of the automated functions currently in place and used by the physical plant department.

THE ASSOCIATION OF PHYSICAL PLANT ADMINISTRATORS
OF UNIVERSITIES AND COLLEGES (APPA)
COMPUTERIZATION QUESTIONNAIRE RESPONDENT DATA

PREPARED BY E G AND G INTERTECH — MAY 16, 1983 - 11 46 AM

| SER NUM | INSTITUTION | CONTACT PERSON | COMPUTER(S) IN USE | FUNCTIONS PERFORMED |
|---|---|---|---|---|
| 0363 | QUESTIONNAIRE HEADING NOT FILLED IN | | TIME SHARING | PERSONNEL RECORDS<br>VACATN AND SICK LV RECDS<br>PAYROLL<br>PREVENTIVE MAINT SCHED<br>PROJECT COST REPORTING<br>EQUIPMENT RECORDS |
| 0378 | AIMS COMMUNITY COLLEGE<br>PHYSICAL PLANT<br>P.O. BOX 69<br>GREELEY COLORADO<br>80632 | DAN TIMBALL<br>(303)339-2243 | | |
| 0074 | ALBANY STATE COLLEGE<br>PLANT OPERATIONS<br>504 COLLEGE DR<br>ALBANY GEORGIA<br>31705 | JACK F. HALL<br>(912)439-4068 | TYPE NOT DEFINED | PREVENTIVE MAINT SCHED |
| 0285 | ALBION COLLEGE<br>PHYSICAL PLANT<br>ALBION MICH<br>48224 | KEN KOLMODIN<br>(517)629-5511 | BURROUGHS UNDEFINED | VACATN AND SICK LV RECDS<br>PAYROLL<br>KEY RECORDS<br>PURCHASE ORDERS |
| 0071 | ALMA COLLEGE<br>PHYSICAL PLANT<br>614 W. SUPERIOR<br>ALMA MICH<br>48801 | L. EUGENE BURR<br>(517)463-7111 | DEC 1170<br>MAGNUSON 80 | PAYROLL<br>INVENTORY RECORDS |
| 0109 | ANDERSON COLLEGE<br>PHYSICAL PLANT DEPT<br>1100 E. 5TH<br>ANDERSON INDIANA<br>46012 | CHARLES STALEY<br>(317)649-9071 | HP3000 | PAYROLL<br>PREVENTIVE MAINT SCHED |
| 0251 | APPALACHIAN STATE UNIVERSITY<br>PHYSICAL PLANT<br>BOONE N.C.<br>28608 | J.D. MCKASKEL<br>(704)262-4015 | UNIVAC 90/80 | PERSONNEL RECORDS<br>VACATN AND SICK LV RECDS<br>PAYROLL<br>PURCHASE ORDERS<br>INVENTORY RECORDS |

THE ASSOCIATION OF PHYSICAL PLANT ADMINISTRATORS
OF UNIVERSITIES AND COLLEGES (APPA)
COMPUTERIZATION QUESTIONNAIRE RESPONDENT DATA

PREPARED BY E G AND G INTERTECH — MAY 16, 1983 - 11 46 AM

| SER NUM | INSTITUTION | CONTACT PERSON | COMPUTER(S) IN USE | FUNCTIONS PERFORMED |
|---|---|---|---|---|
| 0161 | ARAPAHOE COMMUNITY COLLEGE<br>PHYSICAL PLANT<br>5900 S. SANTA FE DRIVE<br>LITTLETON COLORADO<br>80120 | KENNETH D. WHITE<br>(303)797-5758 | DEC VAX | PERSONNEL RECORDS<br>PROJECT COST REPORTING<br>PROJECT BILLING<br>PURCHASE ORDERS<br>INVENTORY RECORDS |
| 0091 | ARIZONA STATE UNIVERSITY<br>PHYSICAL PLANT<br><br>TEMPE ARIZONA<br>85287 | HERBERT MILLER<br>(602)965-5245 | IBM 3081<br>IBM P C | PAYROLL<br>PROJECT BILLING<br>KEY RECORDS |
| 0271 | ATLANTA COLLEGE OF ART<br>FACILITIES MANAGER<br>1280 PEACHTREE ST N.E.<br>ATLANTA GEORGIA<br>30305 | E. JOHN DEBORICK<br>(404)898-1104 | BURROUGHS 1955 | PERSONNEL RECORDS<br>PAYROLL<br>PURCHASE ORDERS |
| 0200 | AUGUSTA COLLEGE<br>PHYSICAL PLANT<br>2500 WALTON WAY<br>AUGUSTA GEORGIA<br>30910 | DR.T.D. MCCRARY<br>(404)828-3766 | TEXAS INST | PERSONNEL RECORDS<br>PAYROLL |
| 0043 | AUGUSTANA COLLEGE<br>PHYSICAL PLANT FACILITIES<br>29TH AND MENLO<br>SIOUX FALLS S.D.<br>57197 | GENE MARKO<br>(605)336-4326 | DEC PDP-11 | PERSONNEL RECORDS<br>VACATN AND SICK LV RECDS<br>PAYROLL |
| 0181 | AUGUSTANA COLLEGE<br>PHYSICAL PLANT<br>639 38TH STREET<br>ROCK ISLAND ILLINOIS<br>61201 | TOM WIESE<br>(309)794-7278 | DEC 1170 | PAYROLL<br>INVENTORY RECORDS |
| 0278 | BALL STATE UNIVERSITY<br>PHYSICAL PLANT<br>2000 UNIVERSITY AVE<br>MUNCIE INDIANA<br>47306 | KENNETH ROTT<br>(317)285-6562 | IBM UNDEFINED | PERSONNEL RECORDS<br>VACATN AND SICK LV RECDS<br>PAYROLL<br>PROJECT ORDER ISSUE<br>PROJECT COST REPORTING<br>PROJECT BILLING<br>PURCHASE ORDERS |

THE ASSOCIATION OF PHYSICAL PLANT ADMINISTRATORS
OF UNIVERSITIES AND COLLEGES (APPA)
COMPUTERIZATION QUESTIONNAIRE RESPONDENT DATA

PREPARED BY E G AND G INTERTECH — MAY 16, 1983 - 11 46 AM

| SER NUM | INSTITUTION | CONTACT PERSON | COMPUTER(S) IN USE | FUNCTIONS PERFORMED |
|---|---|---|---|---|
| 0218 | BAYLOR UNIVERSITY<br>PHYSICAL PLANT DEPT<br>BOX 324<br>WACO TEXAS<br>76798 | R.E. DARLING<br>(817)755-1361 | HONEYWELL DPS-8 | VACATN AND SICK LV RECDS<br>PAYROLL<br>PREVENTIVE MAINT SCHED<br>EQUIPMENT RECORDS<br>PURCHASE ORDERS<br>INVENTORY RECORDS |
| 0234 | BELLARMINE COLLEGE<br>PHYSICAL PLANT<br>NEWBURG ROAD<br>LOUISVILLE KENTUCKY<br>40205 | HERMAN R. SILVERSTEIN<br>(502)452-8117 | DATAPOINT 6600 | PERSONNEL RECORDS<br>VACATN AND SICK LV RECDS<br>PAYROLL<br>EQUIPMENT RECORDS |
| 0055 | BENTLEY COLLEGE<br>PHYSICAL PLANT DEPT<br>BEAVER AND FOREST STS.<br>WALTHAM MASS<br>02254 | JOSEPH A. LUPI<br>(617)891-2205 | PRIME 850 | PREVENTIVE MAINT SCHED<br>PROJECT SCHEDULING<br>PROJECT ESTIMATING<br>PROJECT ORDER ISSUE<br>PROJECT COST REPORTING<br>PROJECT BILLING<br>EQUIPMENT RECORDS<br>PURCHASE ORDERS<br>INVENTORY RECORDS |
| 0248 | BETHEL COLLEGE<br>DIR OF PHYSICAL PLANT<br>1001 W. MCKINLEY AVE<br>MISHAWAKA INDIANA<br>46545 | GEORGE SUMMERS<br>(219)259-8511 | | |
| 0028 | BETHEL COLLEGE AND SEMINARY<br>PHYSICAL PLANT DEPT<br>3900 BETHEL DRIVE<br>ST. PAUL MINN<br>55112 | J.M. WOODS<br>(612)638-6272 | HONEYWELL LEVEL 6/47 | PERSONNEL RECORDS |
| 0349 | BIOLA UNIVERSITY<br>PHYSICAL PLANT<br>13800 BIOLA AVE<br>LA MIRADA CALIF<br>90639 | JON WATSON/GORDON WIENS<br>(213)944-0351 | APPLE III<br>HP3000 | PERSONNEL RECORDS<br>VACATN AND SICK LV RECDS<br>PREVENTIVE MAINT SCHED<br>PROJECT SCHEDULING<br>PROJECT COST REPORTING<br>PROJECT BILLING<br>KEY RECORDS<br>EQUIPMENT RECORDS<br>PURCHASE ORDERS<br>INVENTORY RECORDS |

THE ASSOCIATION OF PHYSICAL PLANT ADMINISTRATORS
OF UNIVERSITIES AND COLLEGES (APPA)
COMPUTERIZATION QUESTIONNAIRE RESPONDENT DATA

PREPARED BY E G AND G INTERTECH — MAY 16, 1983 - 11 46 AM

| SER NUM | INSTITUTION | CONTACT PERSON | COMPUTER(S) IN USE | FUNCTIONS PERFORMED |
|---|---|---|---|---|
| 0061 | BLACKBURN UNIVERSITY<br>PHYSICAL PLANT<br>700 COLLEGE AVE<br>CARLINVILLE ILLINOIS<br>62626 | MARVIN JUBELT<br>(217)854-3231 | | |
| 0206 | BOISE STATE UNIVERSITY<br>PHYSICAL PLANT<br>1910 UNIVERSITY DR<br>BOISE IDAHO<br>83725 | A.G. MCGINNIS | | |
| 0212 | BOWDOIN COLLEGE<br>PHYSICAL PLANT OFFICE<br>RHODES HALL-BOWDOIN COL<br>BRUNSWICK MAINE<br>04011 | | DEC KL1091 | PAYROLL<br>INVENTORY RECORDS |
| 0171 | BRADLEY UNIVERSITY<br>DIRECTOR OF GENERAL SERVICES<br>1501 W. BRADLEY AVE. ,<br>PEORIA ILLINOIS<br>61606 | WILLIAM S. WISE<br>(309)676-7611 | CDC CYBER 170 | PERSONNEL RECORDS<br>PAYROLL<br>EQUIPMENT RECORDS<br>INVENTORY RECORDS |
| 0152 | BRANDEIS UNIVERSITY<br>PLANT OPERATIONS DEPT<br>415 SOUTH ST<br>WALTHAM MASS<br>02154 | JOHN J. FOTI<br>(617)647-2274 | | |
| 0334 | BRIGHAM YOUNG UNIVERSITY<br>BUSINESS INFO AND SUPPORT<br>207 BRWB<br>PROVO UTAH<br>84602 | DOUGLAS K. CHRISTENSEN<br>(801)378-5502 | HONEYWELL LEVEL 6/47 | PERSONNEL RECORDS<br>VACATN AND SICK LV RECDS<br>PAYROLL<br>PREVENTIVE MAINT SCHED<br>PROJECT ESTIMATING<br>PROJECT ORDER ISSUE<br>PROJECT COST REPORTING<br>EQUIPMENT RECORDS<br>PURCHASE ORDERS<br>INVENTORY RECORDS |

THE ASSOCIATION OF PHYSICAL PLANT ADMINISTRATORS
OF UNIVERSITIES AND COLLEGES (APPA)
COMPUTERIZATION QUESTIONNAIRE RESPONDENT DATA

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|---|---|---|---|---|
| 0328 | BROOKLYN COLLEGE<br>BLDGS AND GRNDS-BOX 332<br>BEDFORD AVE + CAMPUS RD<br>BROOKLYN N.Y.<br>11210 | MONTFORD D. NAYLOR JR.<br>(212)780-5171 | IRS 80 M 16 | PERSONNEL RECORDS<br>VACATN AND SICK LV RECDS<br>PAYROLL<br>PURCHASE ORDERS |
| 0256 | BRYANT COLLEGE<br>PHYSICAL PLANT<br>RTE 7<br>SMITHFIELD RHODE IS<br>02917 | B. BRITTON<br>(401)231-1200 | DATA GEN MV600 | PAYROLL<br>PROJECT ORDER ISSUE<br>PROJECT COST REPORTING |
| 0065 | BRYN MAWR COLLEGE<br>PHYSICAL PLANT<br>245 N. ROBERTS ROAD<br>BRYN MAWR PENNA<br>19010 | H.C. DIETZ<br>(215)645-5212 | | |
| 0056 | BUCKNELL UNIVERSITY<br>PHYSICAL PLANT DEPT<br>BUCKNELL UNIVERSITY<br>LEWISBURG PENNA<br>17837 | JOHN A. BELL<br>(717)524-1911 | | PERSONNEL RECORDS<br>VACATN AND SICK LV RECDS<br>PAYROLL |
| 0259 | BUTLER UNIVERSITY<br>PHYSICAL PLANT<br>4600 SUNSET-RM 153-JORDAN HALL<br>INDIANAPOLIS INDIANA<br>46208 | EDWIN V. LYON<br>(317)283-9393 | DEC 1170 | PAYROLL<br>PREVENTIVE MAINT SCHED<br>PROJECT SCHEDULING<br>PROJECT ORDER ISSUE<br>PROJECT COST REPORTING<br>INVENTORY RECORDS |
| 0386 | CALIF STATE POLYTECHNIC UNIVERSITY<br>PHYSICAL PLANT<br>3801 W. TEMPLE AVE<br>POMONA CALIF<br>91768 | SELDON KEMPTON<br>(714)598-4071 | CDC CYBER | PREVENTIVE MAINT SCHED<br>PROJECT COST REPORTING<br>KEY RECORDS |
| 0009 | CALIF STATE UNIVERSITY-CHICO<br>PLANT OPERATION<br>1ST ST. AND HWY 32<br>CHICO CALIF<br>95929 | KAY OVERMAN<br>(916)895-6222 | CDC CYBER | PREVENTIVE MAINT SCHED<br>INVENTORY RECORDS |

THE ASSOCIATION OF PHYSICAL PLANT ADMINISTRATORS
OF UNIVERSITIES AND COLLEGES (APPA)
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|---|---|---|---|---|
| 0018 | CALIF STATE UNIVERSITY-SACRAMENTO<br>PLANT OPERATIONS<br>6000 J STREET<br>SACRAMENTO CALIF<br>95819 | HOWARD HARRIS<br>(916)454-6241 | CDC CYBER<br>CROMEMCO 3<br>DEC 1170 | PREVENTIVE MAINT SCHED<br>PROJECT ORDER ISSUE<br>PROJECT COST REPORTING<br>PROJECT BILLING<br>KEY RECORDS<br>PURCHASE ORDERS |
| 0312 | CALIF STATE UNIV-DOMINGUEZ HILLS<br>PLANT OPERATIONS<br>1000 E. VICTORIA ST<br>CARSON CALIF<br>90747 | SCOTT CHARMACK<br>(213)516-3804 | CDC CYBER 73 | PREVENTIVE MAINT SCHED<br>EQUIPMENT RECORDS |
| 0154 | CALIFORNIA POLYTECHNIC UNIVERSITY<br>PLANT OPERATION<br>SAN LUIS OBISPOCALIF<br>93407 | EDWARD NARETTO<br>(805)546-2326 | TYPE NOT DEFINED | PAYROLL<br>KEY RECORDS |
| 0051 | CALIFORNIA STATE COL-BAKERSFIELD<br>PLANT OPERATIONS<br>9001 STOCKDALE HIGHWAY<br>BAKERSFIELD CALIF<br>93311 | PHILLIP V. BROWN<br>(805)833-2211 | TELRAY 10T | PREVENTIVE MAINT SCHED |
| 0353 | CARLETON UNIVERSITY<br>DEPT OF PHYSICAL PLANT<br>503 ADMIN BLDG<br>OTTAWA ONTARIO<br>CANADA K1S5B6 | JACK COOK<br>(613)231-4405 | TRS 80 M III | VACATN AND SICK LV RECDS<br>PREVENTIVE MAINT SCHED<br>PROJECT SCHEDULING<br>PROJECT ESTIMATING<br>PROJECT COST REPORTING<br>PROJECT BILLING<br>KEY RECORDS<br>EQUIPMENT RECORDS<br>INVENTORY RECORDS |
| 0120 | CECIL COMMUNITY COLLEGE<br>1000 NORTH EAST RD.<br>NORTH EAST MARYLAND<br>21901 | JOHN W. BOYD JR.<br>(301)287-6060 | IBM SERIES I M54 | VACATN AND SICK LV RECDS<br>PAYROLL<br>PURCHASE ORDERS |

THE ASSOCIATION OF PHYSICAL PLANT ADMINISTRATORS
OF UNIVERSITIES AND COLLEGES (APPA)
COMPUTERIZATION QUESTIONNAIRE RESPONDENT DATA

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|---|---|---|---|---|
| 0075 | CENTRAL MICHIGAN UNIVERSITY<br>PHYSICAL PLANT<br>CMU PHYSICAL PLANT<br>MT. PLEASANT MICH<br>48859 | JON MACLEOD<br>(517)774-3401 | IBM 3780 | PERSONNEL RECORDS<br>VACATN AND SICK LV RECDS<br>PAYROLL<br>PREVENTIVE MAINT SCHED<br>PROJECT SCHEDULING<br>PROJECT ORDER ISSUE<br>PROJECT COST REPORTING |
| 0282 | CENTRAL TEXAS COLLEGE<br>PHYSICAL PLANT DIVN<br>WEST HIGHWAY 190<br>KILLEEN TEXAS<br>76541 | HARRY W. POWERS<br>(817)526-1195 | TYPE NOT DEFINED | PAYROLL<br>PREVENTIVE MAINT SCHED<br>PROJECT BILLING<br>INVENTORY RECORDS |
| 0169 | CENTRAL WYOMING COLLEGE<br>PHYSICAL PLANT<br>P.O.BOX 1520<br>RIVERTON WYOMING<br>82501 | J. HANCOCK<br>(307)856-9291 | MICRO DATA 1600 | INVENTORY RECORDS |
| 0143 | CHAMPLAIN REGIONAL COLLEGE<br>554 ONTARIO ST.<br>SHERBROOKE QUEBEC<br>CANADA J1J3R6 | W.T.M. EDWARDS<br>(819)564-3636 | NCR 8200 | PAYROLL<br>INVENTORY RECORDS |
| 0213 | CHICAGO STATE UNIVERSITY<br>CAMPUS PLANNING<br>9501 S. KING DR<br>CHICAGO ILLINOIS<br>60628 | RAYMOND C. ARIAS<br>(312)945-3867 | | |
| 0010 | CLARK COUNTY COMMUNITY COLLEGE<br>OPERATIONS AND MAINTENANCE<br>3200 E. CHEYENNE AVE<br>NORTH LAS VEGASNEVADA<br>89030 | JAMES C. MITCHELL<br>(702)643-6060 | TYPE NOT DEFINED | PERSONNEL RECORDS<br>VACATN AND SICK LV RECDS<br>PAYROLL<br>INVENTORY RECORDS |
| 0191 | CLARK UNIVERSITY<br>PHYSICAL PLANT<br>950 MAIN STREET<br>WORCESTER MASS<br>01610 | SARAH L. PRATT<br>(617)793-7207 | | |

THE ASSOCIATION OF PHYSICAL PLANT ADMINISTRATORS
OF UNIVERSITIES AND COLLEGES (APPA)
COMPUTERIZATION QUESTIONNAIRE RESPONDENT DATA

PREPARED BY E G AND G INTERTECH — MAY 16, 1983 - 11 46 AM

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|---|---|---|---|---|
| 0134 | CLEMSON UNIVERSITY<br>PHYSICAL PLANT<br>CLEMSON S.C.<br>29631 | W.O. STONE JR.<br>(803)656-2186 | IBM 3081<br>IBM SYSTEM 34 | PERSONNEL RECORDS<br>PAYROLL<br>PREVENTIVE MAINT SCHED<br>PROJECT ORDER ISSUE<br>PROJECT COST REPORTING<br>PROJECT BILLING<br>EQUIPMENT RECORDS<br>PURCHASE ORDERS<br>INVENTORY RECORDS |
| 0241 | COLBY COLLEGE<br>PHYSICAL PLANT DEPT<br>MAYFLOWER HILL<br>WATERVILLE MAINE<br>04901 | H. STANLEY PALMER<br>(207)873-1131 | DEC UNDEFINED | PERSONNEL RECORDS<br>PAYROLL |
| 0396 | COLGATE UNIVERSITY<br>HAMILTON N.Y.<br>13346 | AUSTIN G. JOERGER<br>(315)824-1000 | IBM SYSTEM 38 | PERSONNEL RECORDS<br>VACATN AND SICK LV RECDS<br>PAYROLL |
| 0025 | COLLEGE OF THE HOLY CROSS<br>DIRECTOR OF PHYSICAL PLANT<br>1 COLLEGE STREET<br>WORCESTER MASS<br>01610 | RICHARD M. MERIDEEN<br>(617)793-2438 | IBM 4341 | PERSONNEL RECORDS<br>VACATN AND SICK LV RECDS<br>PAYROLL |
| 0049 | COLLEGE OF THE VIRGIN ISLANDS<br>PHYSICAL PLANT<br>ST. THOMAS<br>VIRGIN ISLANDS 00802 | ARNOT CROSLIN<br>(809)774-9200 | | |
| 0134 | COLORADO SCHOOL OF MINES<br>PLANT FACILITIES<br>GOLDEN COLORADO<br>80401 | DICK SUDERMAN<br>(303)273-3330 | DEC 2020 | PERSONNEL RECORDS<br>VACATN AND SICK LV RECDS<br>PAYROLL<br>PROJECT COST REPORTING |
| 0016 | COLORADO STATE UNIVERSITY<br>FACILITIES SERVICES<br>PHYSICAL PLANT NORTH<br>FORT COLLINS COLORADO<br>80523 | LOREN D. LUDWIG<br>(303)491-5302 | TYPE NOT DEFINED | PROJECT ORDER ISSUE<br>PROJECT COST REPORTING<br>PROJECT BILLING |

69

THE ASSOCIATION OF PHYSICAL PLANT ADMINISTRATORS
OF UNIVERSITIES AND COLLEGES (APPA)
COMPUTERIZATION QUESTIONNAIRE RESPONDENT DATA

PREPARED BY E G AND G INTERTECH — MAY 16, 1983 - 11 46 AM

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|---|---|---|---|---|
| 0195 | COLUMBIA UNIV-LAMONT GEOLOG OBSVTRY<br>PHYSICAL PLANT<br>ROUTE 9W<br>PALISADES N.Y.<br>10964 | H. MILLMAN<br>(914)359-2900 | | |
| 0279 | COLUMBUS COLLEGE<br>PLANT OPERATIONS DIVN<br>ALGONQUIN DRIVE<br>COLUMBUS GEORGIA<br>31993 | W.W. WARNER<br>(404)568-2009 | IBM 4341 | EQUIPMENT RECORDS<br>INVENTORY RECORDS |
| 0175 | CONCORDIA COLLEGE<br>PHYSICAL PLANT DEPT<br>901 S. 8TH ST.<br>MOORHEAD MINN<br>56560 | ANSEL O. HAKANSON<br>(218)299-3362 | BURROUGHS UNDEFINED | VACATN AND SICK LV RECDS<br>PAYROLL |
| 0084 | CONNECTICUT COLLEGE<br>PHYSICAL PLANT<br>BOX 1497<br>NEW LONDON CONN<br>06320 | DONALD T. LITTLE<br>(203)447-7546 | PRIME 450-II | PERSONNEL RECORDS<br>PAYROLL<br>PREVENTIVE MAINT SCHED<br>PROJECT COST REPORTING |
| 0216 | COVENANT COLLEGE<br>PHYSICAL PLANT<br>LOOKOUT MTN. TENN<br>37350 | TOM LARSON/BOB HARBERT<br>(404)820-1560 | | |
| 0080 | CUYAHOGA COMMUNITY COLLEGE<br>EASTERN CAMPUS<br>4250 RICHMOND ROAD<br>WARRENSVILLE TOOHIO<br>44122 | D.N. BIELLO<br>(216)464-1450 | HONEYWELL DPS-1 | PERSONNEL RECORDS<br>VACATN AND SICK LV RECDS<br>PAYROLL<br>PROJECT COST REPORTING<br>EQUIPMENT RECORDS |
| 0176 | DALLAS COUNTY COMMUN COL DISTRICT<br>FACILITIES MANAGEMENT/PLANNING<br>4343 N. HIGHWAY 67<br>MESQUITE TEXAS<br>75150 | EDWARD C. BOGARD<br>(214)324-7761 | TYPE NOT DEFINED | PERSONNEL RECORDS<br>VACATN AND SICK LV RECDS<br>PAYROLL<br>EQUIPMENT RECORDS<br>PURCHASE ORDERS<br>INVENTORY RECORDS |

THE ASSOCIATION OF PHYSICAL PLANT ADMINISTRATORS
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|---|---|---|---|---|
| 0063 | DALLAS THEOLOGICAL SEMINARY<br>MANAGEMENT INFORMATION SERVICES<br>3909 SWISS AVENUE<br>DALLAS TEXAS<br>75043 | NOEL ENETE<br>(214)824-3094 | TIME SHARING | PAYROLL |
| 0290 | DANVILLE AREA COMMUNITY COLLEGE<br>DIRECTOR OF PHYSICAL PLANT<br>2000 E. MAIN<br>DANVILLE ILLINOIS<br>61832 | RICHARD DONAHUE<br>(217)943-1811 | FOUR PHASE IV-90 | PERSONNEL RECORDS<br>PAYROLL<br>PURCHASE ORDERS<br>INVENTORY RECORDS |
| 0057 | DARTMOUTH COLLEGE<br>BUILDINGS AND GROUNDS<br>MCKENZIE HALL<br>HANOVER NEW HAMPSHIRE<br>03755 | R.W. PLUMMER<br>(603)646-2485 | TIME SHARING | PERSONNEL RECORDS<br>VACATN AND SICK LV RECDS<br>PAYROLL<br>PROJECT COST REPORTING<br>PROJECT BILLING<br>EQUIPMENT RECORDS<br>INVENTORY RECORDS |
| 0228 | DELTA COLLEGE<br>PHYSICAL PLANT<br>UNIVERSITY CENTMICH<br>48710 | WILLARD READING | | |
| 0006 | DOMINION COLLEGE OF SAN RAFAEL<br>PHYSICAL PLANT<br>GRAND AND ACACIA AVE.<br>SAN RAFAEL CAL.<br>94901 | JON MILLS<br>(415)457-4440 | | |
| 0324 | DREW UNIVERSITY<br>PHYSICAL PLANT<br>36 MADISON AVE<br>MADISON N.J.<br>07940 | ERIC SANDBERG<br>(201)377-3000 | PRIME I-1000<br>HP3000 | PERSONNEL RECORDS<br>VACATN AND SICK LV RECDS<br>PAYROLL<br>PROJECT ORDER ISSUE<br>PROJECT COST REPORTING<br>PROJECT BILLING<br>KEY RECORDS<br>PURCHASE ORDERS<br>INVENTORY RECORDS |

THE ASSOCIATION OF PHYSICAL PLANT ADMINISTRATORS
OF UNIVERSITIES AND COLLEGES (APPA)
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|---|---|---|---|---|
| 0086 | DREXEL UNIVERSITY<br>PHYSICAL PLANT<br>34TH AND MARKET STREETS<br>PHILADELPHIA PENNA<br>19104 | JOHN H. MUELLER<br>(215)895-2806 | IBM 3081<br>TIME SHARING | PERSONNEL RECORDS<br>VACATN AND SICK LV RECDS<br>PAYROLL<br>PREVENTIVE MAINT SCHED<br>PROJECT SCHEDULING<br>INVENTORY RECORDS |
| 0021 | DUKE UNIVERSITY<br>PHYSICAL PLANT DEPT<br>204 MAINTENANCE BLDG<br>DURHAM N.C.<br>27707 | NORMAN BEDELL<br>(919)684-3611 | | |
| 0088 | DUNDALK COMMUNITY COLLEGE<br>PLANT OPERATIONS<br>7200 SOLLERS POINT RD<br>BALTIMORE MARYLAND<br>21222 | S.H. ADAMS JR.<br>(301)285-7459 | TYPE NOT DEFINED | PAYROLL |
| 0085 | EARLHAM COLLEGE<br>DIR PLANT AND PURCHASING<br>NAT. ROAD WEST<br>RICHMOND INDIANA<br>47374 | JOHN SWEITZER<br>(317)962-6561 | DEC UNDEFINED | INVENTORY RECORDS |
| 0289 | EAST CENTRAL COLLEGE<br>BUSINESS OFFICE<br>P.O. BOX 529<br>UNION MISSOURI<br>63084 | H. DUANE CAMPBELL<br>(314)583-5193 | | |
| 0284 | EAST TENNESSEE STATE UNIVERSITY<br>PHYSICAL PLANT<br>P.O. BOX 22090A<br>JOHNSON CITY TENN<br>37614 | J.L. SEEHORN<br>(615)929-4445 | IBM 4341 | PERSONNEL RECORDS<br>VACATN AND SICK LV RECDS<br>PAYROLL<br>EQUIPMENT RECORDS<br>INVENTORY RECORDS |
| 0170 | EASTERN ILLINOIS UNIVERSITY<br>PHYSICAL PLANT SERVICES<br><br>CHARLESTON ILLINOIS<br>61720 | | IBM P C | PROJECT ESTIMATING<br>KEY RECORDS<br>PURCHASE ORDERS |

THE ASSOCIATION OF PHYSICAL PLANT ADMINISTRATORS
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|---|---|---|---|---|
| 0097 | EASTERN MICHIGAN UNIVERSITY<br>PHYSICAL PLANT DEPT<br>YPSILANTI MICH<br>48197 | WILLIAM SMART<br>(313)487-4194 | BARBER COLEMAN ECON IV | PREVENTIVE MAINT SCHED |
| 0136 | EASTERN MONTANA COLLEGE<br>PHYSICAL PLANT<br>1500 N. 30TH ST.<br>BILLINGS MONTANA<br>59101 | RICHARD HEDMAN<br>(406)657-2309 | DEC UNDEFINED | PERSONNEL RECORDS<br>VACATN AND SICK LV RECDS<br>PAYROLL<br>PROJECT COST REPORTING<br>PROJECT BILLING<br>INVENTORY RECORDS |
| 0321 | EASTERN NEW MEXICO UNIVERSITY<br>PHYS PLANT-STATION NO. 23<br>PORTALES N.MEXICO<br>88130 | | APPLE III | PERSONNEL RECORDS<br>VACATN AND SICK LV RECDS<br>PROJECT COST REPORTING<br>PROJECT BILLING<br>KEY RECORDS |
| 0145 | EASTERN WASHINGTON UNIVERSITY<br>FACILITIES<br>CHENEY WASH<br>99004 | ROBERT GRAHAM<br>(509)359-6323 | DEC 1134 | PREVENTIVE MAINT SCHED<br>PROJECT COST REPORTING<br>PROJECT BILLING<br>KEY RECORDS |
| 0138 | EL PASO COMMUNITY COLLEGE<br>PHYSICAL PLANT<br>P.O. BOX 20500<br>EL PASO TEXAS<br>79998 | CECIL LANCE<br>(915)594-2556 | BARBER COLEMAN ECON IV | PREVENTIVE MAINT SCHED |
| 0338 | ELMHURST COLLEGE<br>PHYSICAL PLANT<br>190 PROSPECT<br>ELMHURST ILLINOIS<br>60126 | BRUCE MATHER<br>(312)279-4100 | HARRIS | PERSONNEL RECORDS<br>PROJECT COST REPORTING |
| 0119 | ELON COLLEGE<br>PHYSICAL PLANT<br>BOX 2111 ELON COLLEGE<br>ELON COLLEGE N.C.<br>27244 | DAVID WALL/L.B.MCCAULEY<br>(919)584-2399 | MICRO-DATA ROYALE | PERSONNEL RECORDS<br>VACATN AND SICK LV RECDS<br>PAYROLL<br>KEY RECORDS<br>PURCHASE ORDERS |

THE ASSOCIATION OF PHYSICAL PLANT ADMINISTRATORS
OF UNIVERSITIES AND COLLEGES (APPA)
COMPUTERIZATION QUESTIONNAIRE RESPONDENT DATA

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| 0373 | EMBRY-RIDDLE AERONAUTICAL UNIV<br>PHYSICAL PLANT<br>DAYTONABEACH REGIONAL AIRPORT<br>DAYTONA BEACH FLORIDA<br>32019 | PHIL BIRD<br>(904)252-5561 | HP3000<br>BARBER COLEMAN ECON IV | PERSONNEL RECORDS<br>VACATN AND SICK LV RECDS<br>PAYROLL<br>PREVENTIVE MAINT SCHED<br>PROJECT SCHEDULING<br>PROJECT ESTIMATING<br>PROJECT ORDER ISSUE<br>PROJECT COST REPORTING<br>PROJECT BILLING<br>PURCHASE ORDERS<br>INVENTORY RECORDS |
| 0379 | EMPORIA STATE UNIVERSITY<br>PHYSICAL PLANT<br>1200 COMMERCIAL<br>EMPORIA KANSAS<br>66801 | JOHN GREENE<br>(316)343-1200 | HONEYWELL DELTA 1000<br>IBM 4341 | PREVENTIVE MAINT SCHED<br>KEY RECORDS<br>INVENTORY RECORDS |
| 0015 | FAIRFIELD UNIVERSITY<br>DIR OF BLDGS AND GROUNDS<br>NORTH BENSON RD.<br>FAIRFIELD CONN<br>06430 | F.W. COTTER<br>(203)255-5411 | DEC 2060 | PERSONNEL RECORDS<br>PURCHASE ORDERS |
| 0182 | FOOTHILL DE ANZA COMUNTY COL DIST<br>PLANT AND MATL SERVICES<br>12345 EL MONTE RD<br>LOS ALTOS HILLSCALIF<br>94022 | MAL DEAL<br>(415)948-8590 | IBM 4341 | PERSONNEL RECORDS<br>VACATN AND SICK LV RECDS<br>PAYROLL<br>EQUIPMENT RECORDS |
| 0245 | FORT HAYS STATE UNIVERSITY<br>OFFICE OF PHYSICAL PLANT<br>600 PARK ST<br>HAYS KANSAS<br>67601 | FRANCIS O. MURRAY<br>(913)628-4424 | IBM 370-135<br>TRS 80 M II | PERSONNEL RECORDS<br>VACATN AND SICK LV RECDS<br>PAYROLL<br>PROJECT SCHEDULING<br>PROJECT COST REPORTING<br>KEY RECORDS<br>EQUIPMENT RECORDS<br>INVENTORY RECORDS |
| 0294 | FREDERICK COMMUNITY COLLEGE<br>INSTITUTIONAL SERVICES<br>7923 OPOSSUMTOWN PIKE<br>FREDERICK MARYLAND<br>21701 | JON. H. LARSON<br>(301)694-1233 | HP3000 | VACATN AND SICK LV RECDS<br>PAYROLL<br>PURCHASE ORDERS<br>INVENTORY RECORDS |

THE ASSOCIATION OF PHYSICAL PLANT ADMINISTRATORS
OF UNIVERSITIES AND COLLEGES (APPA)
COMPUTERIZATION QUESTIONNAIRE RESPONDENT DATA

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|---|---|---|---|---|
| 0341 | GALLAUDET COLLEGE<br>MAINT + OPERATIONS DEPT<br>800 FLORIDA AVE N.E.<br>WASHINGTON D.C.<br>20002 | HOWARD CIHAK<br>(202)651-5231 | TIME SHARING | PAYROLL |
| 0047 | GEORGE BROWN COLLEGE OF APPLIED ART<br>PHYSICAL RESOURCES<br>P.O. BOX 1015-STATION B<br>TORONTO ONTARIO<br>CANADA M5T2T9 | D. COPSEY<br>(416)967-1212 | HONEYWELL DELTA 6607 | PREVENTIVE MAINT SCHED |
| 0292 | GEORGE MASON UNIVERSITY<br>BLDGS AND GRNDS<br>4400 UNIVERSITY DRIVE<br>FAIRFAX VIRGINIA<br>22030 | E.V. MCKEEVER<br>(703)323-2410 | HP3000 | PAYROLL |
| 0180 | GEORGETOWN UNIVERSITY<br>PHYSICAL PLANT<br>3700 O STREET N.W.<br>WASHINGTON D.C.<br>20057 | JOHN C. MILLER<br>(202)625-4351 | IBM 148 | VACATN AND SICK LV RECDS<br>PAYROLL<br>PREVENTIVE MAINT SCHED<br>EQUIPMENT RECORDS<br>PURCHASE ORDERS |
| 0024 | GEORGIA SOUTHERN COLLEGE<br>PHYSICAL PLANT<br>LANDRUM BOX 8012<br>STATESBORO GEORGIA<br>30460 | FRED N. SHROYER<br>(912)681-5558 | BURROUGHS 2800 | PROJECT COST REPORTING<br>PROJECT BILLING<br>EQUIPMENT RECORDS |
| 0117 | GORDON COLLEGE<br>PHYSICAL PLANT<br>WENHAM MASS<br>01984 | CHARLES HARDING<br>(617)927-2300 | DEC 1170 | PAYROLL |
| 0332 | GRAND VALLEY STATE COLLEGES<br>PHYSICAL PLANT<br>ALLENDALE MICH<br>49401 | JAMES HAM<br>(616)895-6639 | | |
| 0384 | GREEN RIVER COMMUNITY COLLEGE<br>MAINTENANCE DEPARTMENT<br>12401 SOUTHEAST 320 ST<br>AUBURN WASHINGTON<br>98002 | HAROLD BROADBENT<br>(206)833-9111 | | |

THE ASSOCIATION OF PHYSICAL PLANT ADMINISTRATORS
OF UNIVERSITIES AND COLLEGES (APPA)
COMPUTERIZATION QUESTIONNAIRE RESPONDENT DATA

PREPARED BY E G AND G INTERTECH

MAY 16, 1983 - 11 46 AM

| SER NUM | INSTITUTION | CONTACT PERSON | COMPUTER(S) IN USE | FUNCTIONS PERFORMED |
|---|---|---|---|---|
| 0315 | GRIFFITH UNIVERSITY<br>SITE AND BLDGS DIVN<br><br>NATHAN QUEENSLAND<br>AUSTRALIA 4111 | S. RAGUSA<br>(07)275-7149 | TYPE NOT DEFINED | PAYROLL<br>EQUIPMENT RECORDS<br>INVENTORY RECORDS |
| 0202 | HAMILTON COLLEGE<br>DEPT OF PHYSICAL PLANT<br>HAMILTON COLLEGE<br>CLINTON N.Y.<br>13323 | ALAN LEWIS<br>(315)859-7218 | NCR 8455 | PAYROLL<br>INVENTORY RECORDS |
| 0042 | HARVARD UNIVERSITY<br>DEPT OF BLDGS AND GROUNDS<br>175 NORTH HARVARD STREET<br>ALLSTON MASS<br>02134 | T. TINGEY/T. TRIBBLE<br>(617)-4309/56 | DATA GENERAL C350 | PERSONNEL RECORDS<br>VACATN AND SICK LV RECDS<br>PAYROLL<br>PREVENTIVE MAINT SCHED<br>PROJECT ESTIMATING<br>PROJECT COST REPORTING<br>PROJECT BILLING<br>PURCHASE ORDERS<br>INVENTORY RECORDS |
| 0266 | HAVERFORD COLLEGE<br>DEPT OF PHYSICAL PLANT<br><br>PHILADELPHIA PENNA<br>19041 | RICHARD CARINCI<br>(215)896-1102 | APPLE II | PROJECT ORDER ISSUE<br>PROJECT COST REPORTING<br>PROJECT BILLING<br>PURCHASE ORDERS |
| 0178 | HOCKING TECHNICAL COLLEGE<br>SUPT OF BLDGS AND GRNDS<br>ROUTE 1<br>NELSONVILLE OHIO<br>45764 | FRANK W. DOWNHOUR<br>(614)753-3591 | HP3000 | PAYROLL<br>EQUIPMENT RECORDS |
| 0114 | ILLINOIS STATE UNIVERSITY<br>PHYSICAL PLANT<br>600 W. GREGORY<br>NORMAL ILLINOIS<br>61761 | R.E. KIRK<br>(309)438-5611 | NAT ADV SYST AS7000 | PERSONNEL RECORDS<br>VACATN AND SICK LV RECDS<br>PAYROLL<br>PROJECT COST REPORTING<br>PROJECT BILLING<br>KEY RECORDS<br>EQUIPMENT RECORDS<br>PURCHASE ORDERS |

THE ASSOCIATION OF PHYSICAL PLANT ADMINISTRATORS
OF UNIVERSITIES AND COLLEGES (APPA)
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|---|---|---|---|---|
| 0298 | ILLINOIS WESLEYAN UNIVERSITY<br>PHYSICAL PLANT<br>P.O. BOX 2900<br>BLOOMINGTON ILLINOIS<br>61701 | GEORGE R. SHAVER<br>(309)556-3066 | | |
| 0197 | INDIANA UNIVERSITY NORTHWEST<br>PHYSICAL PLANT<br>3400 BROADWAY<br>GARY INDIANA<br>46408 | GERALD MCCAIG<br>(219)980-6710 | PRIME 750 | PERSONNEL RECORDS<br>PREVENTIVE MAINT SCHED<br>KEY RECORDS<br>EQUIPMENT RECORDS<br>PURCHASE ORDERS |
| 0307 | INDIANA UNIVERSITY SOUTHEAST<br>PHYSICAL PLANT<br>4201 GRANT LINE RD<br>NEW ALBANY INDIANA<br>47243 | ED FREDERICK<br>(812)945-2731 | | |
| 0300 | INDIANA VOCATIONAL TECHNICAL COL<br>DIRECTOR OF REGIONAL SVCS<br>4100 COWAN RD<br>MUNCIE INDIANA<br>47302 | RON E. PUCKETT<br>(317)289-2291 | IBM UNDEFINED | PERSONNEL RECORDS<br>VACATN AND SICK LV RECDS<br>PAYROLL<br>EQUIPMENT RECORDS<br>INVENTORY RECORDS |
| 0291 | INDIANA VOCATIONAL TECHNICAL COL<br>PHYSICAL PLANT DEPT.<br>8204 HIGHWAY 311<br>SELLERSBURG INDIANA<br>47172 | DOYLE R. BERRY<br>(812)246-3301 | TYPE NOT DEFINED | PERSONNEL RECORDS<br>VACATN AND SICK LV RECDS<br>PAYROLL<br>EQUIPMENT RECORDS<br>INVENTORY RECORDS |
| 0354 | IOWA STATE UNIVERSITY<br>PHYSICAL PLANT<br>AMES IOWA<br>50011 | W.W. WHITMAN<br>(515)294-8079 | IBM 4341<br>MICRO-DATA 6000 | PERSONNEL RECORDS<br>VACATN AND SICK LV RECDS<br>PAYROLL<br>PROJECT SCHEDULING<br>PROJECT ESTIMATING<br>PROJECT COST REPORTING<br>PROJECT BILLING<br>KEY RECORDS<br>EQUIPMENT RECORDS<br>PURCHASE ORDERS<br>INVENTORY RECORDS |

THE ASSOCIATION OF PHYSICAL PLANT ADMINISTRATORS
OF UNIVERSITIES AND COLLEGES (APPA)
COMPUTERIZATION QUESTIONNAIRE RESPONDENT DATA

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|---|---|---|---|---|
| 0318 | JAMES COOK UNIV OF N. QUEENSLAND<br>BLDGS AND GRNDS DIVN<br>POST OFFICE<br>QUEENSLAND<br>AUSTRALIA Q4811 | E.A. DEWS<br>(077)814325 | DEC 10 | PAYROLL<br>PROJECT COST REPORTING |
| 0262 | JOHN BROWN UNIVERSITY<br>PHYSICAL PLANT<br>JBU 3033<br>SILOAM SPRINGS ARIZONA<br>72761 | BOYCE MCQUAY<br>(501)524-3131 | | |
| 0162 | JOHNSON STATE COLLEGE<br>PHYSICAL OPERATIONS<br>JOHNSON VERMONT<br>05656 | DONALD B. JOHNSON<br>(802)635-2356 | HARRIS<br>DEC VAX | PAYROLL<br>PROJECT BILLING<br>PURCHASE ORDERS |
| 0133 | KANSAS STATE UNIVERSITY<br>DIVN OF UNIVERSITY FACILITIES<br>MANHATTAN KANSAS<br>66506 | FRED FERGUSON<br>(913)532-6369 | IBM DISPLAYWRITER<br>IBM 4341 | PERSONNEL RECORDS<br>VACATN AND SICK LV RECDS<br>PAYROLL<br>KEY RECORDS<br>PURCHASE ORDERS<br>INVENTORY RECORDS |
| 0062 | KEARNEY STATE COLLEGE<br>PHYSICAL PLANT<br>KEARNEY NEBRASKA<br>68849 | TOM JONES<br>(308)236-4067 | | PREVENTIVE MAINT SCHED |
| 0337 | KENYON COLLEGE<br>BUSINESS SERVICES<br>GAMBIER OHIO<br>43022 | JOHN KURELLA<br>(614)427-2244 | DEC 1170 | VACATN AND SICK LV RECDS<br>PAYROLL |
| 0357 | KEYANO COLLEGE<br>PHYSICAL PLANT DIVN<br>8115 FRANKLIN AVE<br>FORT MCMURRAY ALBERTA<br>CANADA T9H2H7 | BARRY R. WALKER<br>(403)791-4800 | DEC VAX | PERSONNEL RECORDS<br>VACATN AND SICK LV RECDS<br>PAYROLL<br>PURCHASE ORDERS<br>INVENTORY RECORDS |

THE ASSOCIATION OF PHYSICAL PLANT ADMINISTRATORS
OF UNIVERSITIES AND COLLEGES (APPA)
COMPUTERIZATION QUESTIONNAIRE RESPONDENT DATA

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|---|---|---|---|---|
| 0196 | KNOX COLLEGE<br>PHYSICAL PLANT<br><br>GALESBURG ILLINOIS<br>61401 | J.G. VACEK<br>(309)343-0112 | DEC 1140 | PERSONNEL RECORDS<br>VACATN AND SICK LV RECDS<br>PAYROLL |
| 0296 | LAFAYETTE COLLEGE<br>PLANT OPERATIONS<br>LAFAYETTE COLLEGE<br>EASTON PENNA<br>18042 | W.R. LEDDER<br>(215)250-5374 | | |
| 0149 | LAKE ERIE COLLEGE<br>SERVICE DEPT<br>391 W. WASHINGTON ST.<br>PAINESVILLE OHIO<br>44077 | WM. KARNOSH<br>(216)352-3361 | TIME SHARING | PAYROLL<br>PURCHASE ORDERS |
| 0235 | LAKE FOREST COLLEGE<br>DEPT OF PHYSICAL PLANT<br>COLLEGE AND SHERIDAN RDS<br>LAKE FOREST ILLINOIS<br>60045 | GORDON L. KENSGAARD<br>(312)234-3100 | TRS 80 M 1 | PREVENTIVE MAINT SCHED<br>PROJECT SCHEDULING<br>PROJECT BILLING<br>KEY RECORDS<br>EQUIPMENT RECORDS<br>PURCHASE ORDERS<br>INVENTORY RECORDS |
| 0340 | LAKE MICHIGAN COLLEGE<br>DIR OF BLDGS AND GRNDS<br>2755 E. NAPIER<br>BENTON HARBOR MICH<br>49022 | | TIME SHARING | PAYROLL |
| 0376 | LAKEHEAD UNIVERSITY<br>PHYSICAL PLANT<br>THUNDER BAY ONTARIO<br>CANADA P7B5E1 | ART DAVIES<br>(807)345-2121 | DEC VAX | PAYROLL |
| 0203 | LAKESHORE TECHNICAL INSTITUTE<br>PHYSICAL PLANT<br>1290 NORTH AVE<br>CLEVELAND WISCONSIN<br>53015 | DENNIS A. THIEL<br>(414)458-4183 | IBM SYSTEM 38 | VACATN AND SICK LV RECDS<br>PAYROLL<br>PURCHASE ORDERS<br>INVENTORY RECORDS |

THE ASSOCIATION OF PHYSICAL PLANT ADMINISTRATORS
OF UNIVERSITIES AND COLLEGES (APPA)
COMPUTERIZATION QUESTIONNAIRE RESPONDENT DATA

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|---|---|---|---|---|
| 0320 | LANDER COLLEGE<br>PHYSICAL PLANT<br><br>GREENWOOD S.CAROLINA<br>29646 | GEORGE FRANKE<br>(803)229-8201 | TYPE NOT DEFINED | PAYROLL<br>PURCHASE ORDERS<br>INVENTORY RECORDS |
| 0156 | LANGSTON UNIVERSITY<br>PHYSICAL PLANT<br>LANGSTON OKLAHOMA<br>73050 | ROBERT REYNOLDS<br>(405)466-2231 | IBM UNDEFINED | INVENTORY RECORDS |
| 0355 | LANSING COMMUNITY COLLEGE<br>PHYSICAL PLANT DEPT<br>P.O. BOX 40010-315 N. GRAND AVE<br>LANSING MICH<br>48901 | PAUL ENGSTROM<br>(517)483-1808 | IBM 4341 | PAYROLL |
| 0004 | LAVAL UNIVERSITY<br>BLDGS AND GROUNDS SERVICES<br>CITE UNIVERSITAIRE<br>QUEBEC<br>CANADA G1K7P4 | | TYPE NOT DEFINED | PERSONNEL RECORDS<br>VACATN AND SICK LV RECDS<br>PAYROLL<br>PREVENTIVE MAINT SCHED<br>PROJECT SCHEDULING<br>PROJECT ORDER ISSUE<br>PROJECT COST REPORTING<br>PROJECT BILLING |
| 0165 | LIBERTY BAPTIST COLLEGE<br>PHYSICAL PLANT<br>3765 CANDLERS MTN. RD.<br>LYNCHBURG VIRGINIA<br>24506 | BYRON L. BAKER<br>(804)237-5961 | IBM 4200 | PAYROLL<br>PREVENTIVE MAINT SCHED<br>PROJECT SCHEDULING<br>PROJECT ESTIMATING<br>PROJECT ORDER ISSUE<br>PROJECT COST REPORTING<br>PROJECT BILLING<br>KEY RECORDS<br>EQUIPMENT RECORDS<br>PURCHASE ORDERS<br>INVENTORY RECORDS |
| 0157 | LINCOLNLAND COMMUNITY COLLEGE<br>BUILDINGS AND GROUNDS<br>SHEPERD ROAD<br>SPRINGFIELD ILLINOIS<br>62708 | JOHN T. COSTELLO<br>(217)786-2303 | IBM UNDEFINED | KEY RECORDS |

THE ASSOCIATION OF PHYSICAL PLANT ADMINISTRATORS
OF UNIVERSITIES AND COLLEGES (APPA)
COMPUTERIZATION QUESTIONNAIRE RESPONDENT DATA

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|---|---|---|---|---|
| 0026 | LOS ANGELES COMMUNITY COLLEGE DIST<br>ADMINISTRATIVE OFFICE<br>617 WEST 7TH STREET<br>LOS ANGELES CALIF<br>90017 | GEORGE EALER<br>(213)628-7788 | HONEYWELL LEVEL 66-60 | PERSONNEL RECORDS<br>VACATN AND SICK LV RECDS<br>PAYROLL |
| 0280 | LOUISIANA STATE UNIVERSITY<br>PHYSICAL PLANT<br><br>BATON ROUGE LOUISIANA<br>70803 | ROBERT MARTIN<br>(504)388-6964 | IBM 3033<br>DATAPOINT 1800 | PERSONNEL RECORDS<br>PAYROLL<br>PREVENTIVE MAINT SCHED<br>PROJECT COST REPORTING<br>PROJECT BILLING |
| 0316 | LOUSIANA STATE UNIV IN SHREVEPORT<br>PHYSICAL PLANT<br>8515 YOUREE DRIVE<br>SHREVEPORT LOUISIANA<br>71115 | GEORGE KALMBACH<br>(318)797-5260 | IBM 4341 | PERSONNEL RECORDS<br>VACATN AND SICK LV RECDS<br>PAYROLL<br>INVENTORY RECORDS |
| 0052 | LOYOLA UNIVERSITY<br>DIRECTOR OF ENERGY MANAGEMENT<br>6363 ST.CHARLES AVE<br>NEW ORLEANS LOUISIANA<br>70118 | MANUEL VEGA<br>(504)865-3169 | IBM 370 158<br>DEC 1134 | PERSONNEL RECORDS<br>VACATN AND SICK LV RECDS<br>PAYROLL<br>PREVENTIVE MAINT SCHED<br>EQUIPMENT RECORDS<br>PURCHASE ORDERS |
| 0070 | LOYOLA UNIVERSITY OF CHICAGO<br>PHYSICAL PLANT AND GROUNDS<br>6525 SHERIDAN RD<br>CHICAGO ILLINOIS<br>60620 | ALLEN L. ECKARDT<br>(312)274-3000 | TRS 80 M III | PERSONNEL RECORDS |
| 0389 | LSU MEDICAL CENTER-SHREVEPORT<br>PHYSICAL PLANT<br>P.O. BOX 33932<br>SHREVEPORT LOUISIANA<br>71130 | R.W. SAVELL<br>(318-674-6300 | IBM 4331<br>IBM 3033<br>FOUR PHASE IV-90<br>DEC UNDEFINED | PERSONNEL RECORDS<br>VACATN AND SICK LV RECDS<br>PAYROLL<br>PROJECT SCHEDULING<br>PROJECT ESTIMATING<br>PROJECT ORDER ISSUE<br>PROJECT COST REPORTING<br>KEY RECORDS<br>EQUIPMENT RECORDS<br>PURCHASE ORDERS<br>INVENTORY RECORDS |

THE ASSOCIATION OF PHYSICAL PLANT ADMINISTRATORS
OF UNIVERSITIES AND COLLEGES (APPA)
COMPUTERIZATION QUESTIONNAIRE RESPONDENT DATA

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|---|---|---|---|---|
| 0005 | MACALESTER COLLEGE<br>PHYSICAL PLANT<br>1600 GRAND AVENUE<br>ST. PAUL MINNESOTA<br>55105 | MARK D. DICKINSON<br>(612)696-6278 | TYPE NOT DEFINED | PAYROLL<br>INVENTORY RECORDS |
| 0397 | MANCHESTER COLLEGE<br>PHYSICAL PLANT<br>W. COLLEGE AVE<br>NORTH MANCHESTEINDIANA<br>46962 | JERRY RADERSTORF<br>(219)982-2141 | IBM SYSTEM 34 | PERSONNEL RECORDS<br>PAYROLL<br>KEY RECORDS |
| 0360 | MASSACHUSETTS INST OF TECHNOLOGY<br>PHYSICAL PLANT<br>77 MASS AVE-ROOM E18-260<br>CAMBRIDGE MASS<br>02139 | THOMAS E. SHEPHER JR.<br>(617)253-6358 | IBM 370 | PAYROLL<br>PREVENTIVE MAINT SCHED<br>PROJECT COST REPORTING<br>PROJECT BILLING<br>KEY RECORDS<br>PURCHASE ORDERS<br>INVENTORY RECORDS |
| 0210 | MAUI COMMUN COLLEGE (U.OF HAWAII)<br>ADMIN SERVICES<br>310 KAAHUMANU AVE<br>KAHULUI HAWAII<br>(MAUI) 96732 | WARREN MOTOSUE<br>(808)244-9181 | IBM 370 | PERSONNEL RECORDS<br>VACATN AND SICK LV RECDS<br>PAYROLL<br>EQUIPMENT RECORDS<br>INVENTORY RECORDS |
| 0309 | MCGILL UNIVERSITY<br>PHYSICAL PLANT<br>840 AVENUE DOCTEUR PENFIELD<br>MONTREAL QUEBEC<br>CANADA H3A1A4 | JOHN L. MARTIN<br>(514)392-4385 | AAMDAHL V7A | PERSONNEL RECORDS<br>VACATN AND SICK LV RECDS<br>PAYROLL<br>PROJECT ORDER ISSUE<br>PROJECT COST REPORTING<br>PROJECT BILLING<br>EQUIPMENT RECORDS<br>PURCHASE ORDERS<br>INVENTORY RECORDS |
| 0060 | MCMASTER UNIVERSITY<br>DEPT OF PHYSICAL PLANT<br>1280 MAIN STREET WEST<br>HAMILTON ONTARIO<br>CANADA L8S4M3 | P.F. MCNICHOL<br>(416)525-9140 | | |

THE ASSOCIATION OF PHYSICAL PLANT ADMINISTRATORS
OF UNIVERSITIES AND COLLEGES (APPA)
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|---|---|---|---|---|
| 0365 | MEDICAL COLLEGE OF OHIO<br>PHYSICAL PLANT AND MAINT.<br>C.S. 10008<br>TOLEDO OHIO<br>43699 | RUSSELL W. RICE<br>(419)381-4192 | | |
| 0400 | MEMORIAL UNIV OF NEWFOUNDLAND<br>DEPT OF UNIVERSITY WORKS<br>ST. JOHN'S NEWFOUNDLAND<br>CANADA A1B3X7 | MILLAR EWING<br>(709)737-8719 | | |
| 0246 | MERCER UNIVERSITY<br>PHYSICAL PLANT<br>1400 COLEMAN AVE<br>MACON GEORGIA<br>31207 | ROBERT NEAL<br>(912)744-2900 | BURROUGHS 1955 | PAYROLL<br>INVENTORY RECORDS |
| 0034 | METROPOLITAN TECHNICAL COMUNTY COL<br>V.P.FINANCE AND ADMIN SERVICES<br>P.O.BOX 3777<br>OMAHA NEBRASKA<br>68103 | RICHARD M. BAER<br>(402)449-8403 | TYPE NOT DEFINED | PERSONNEL RECORDS<br>VACATN AND SICK LV RECDS<br>PAYROLL<br>PREVENTIVE MAINT SCHED<br>PROJECT SCHEDULING<br>PROJECT ESTIMATING<br>PROJECT ORDER ISSUE<br>PROJECT COST REPORTING<br>PROJECT BILLING<br>KEY RECORDS<br>EQUIPMENT RECORDS<br>PURCHASE ORDERS<br>INVENTORY RECORDS |
| 0317 | MICHIGAN STATE UNIVERSITY<br>PHYSICAL PLANT DIVN<br>PHYS PLANT BLDG<br>EAST LANSING MICH<br>48824 | T.B. SIMON<br>(517)355-3366 | CDC CYBER 170<br>IBM 370<br>TRS 80 M II | PERSONNEL RECORDS<br>VACATN AND SICK LV RECDS<br>PAYROLL<br>PREVENTIVE MAINT SCHED<br>PROJECT SCHEDULING<br>PROJECT ORDER ISSUE<br>PROJECT COST REPORTING<br>PROJECT BILLING<br>KEY RECORDS<br>EQUIPMENT RECORDS<br>PURCHASE ORDERS<br>INVENTORY RECORDS |

THE ASSOCIATION OF PHYSICAL PLANT ADMINISTRATORS
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| 0002 | MIDWESTERN STATE UNIVERSITY<br>PHYSICAL PLANT<br>3410 TAFT<br>WICHITA FALLS TEXAS<br>76308 | R.C. ALLEY<br>(817)692-6611 | TYPE NOT DEFINED | PAYROLL<br>KEY RECORDS<br>EQUIPMENT RECORDS |
| 0208 | MILLIKIN UNIVERSITY<br>PHYSICAL PLANT<br>1184 W. MAIN<br>DECATUR ILLINOIS<br>62522 | WM. EDDY<br>(217)424-6312 | DEC VAX | VACATN AND SICK LV RECDS<br>PAYROLL |
| 0215 | MINNEAPOLIS SOCIETY OF FINE ARTS<br>PROPERTIES<br>2400 3RD AVE. S.<br>MINNEAPOLIS MINN<br>55404 | HARLAN NELSON<br>(612)870-3020 | | |
| 0159 | MOHAWK VALLEY COMMUNITY COLLEGE<br>PHYSICAL PLANT<br>1101 SHERMAN DR.<br>UTICA N.Y.<br>13304 | JOHN SEMERARO<br>(315)797-9530 | UNIVAC 9030-60 | PERSONNEL RECORDS<br>VACATN AND SICK LV RECDS<br>PAYROLL<br>PURCHASE ORDERS |
| 0352 | MONTANA STATE UNIVERSITY<br>PHYSICAL PLANT DEPT<br>BOZEMAN MONTANA<br>59717 | PAT SIMMONS<br>(406)994-2001 | IBM SYSTEM 34 | PROJECT COST REPORTING<br>PROJECT BILLING<br>EQUIPMENT RECORDS<br>INVENTORY RECORDS |
| 0124 | MONTGOMERY COLLEGE<br>DIRECTOR OF FACILITIES<br>51 MANNAKEE STREET<br>ROCKVILLE MARYLAND<br>20850 | MS. EVELYN A. MILLER<br>(301)279-5371 | TYPE NOT DEFINED | PERSONNEL RECORDS<br>VACATN AND SICK LV RECDS<br>PAYROLL |
| 0295 | MOORE COLLEGE OF ART<br>20TH AND RACE STS<br>PHILADELPHIA PENNA<br>19103 | RONALD E. BOWDEN<br>(215)568-4515 | BURROUGHS 7000 | PURCHASE ORDERS |

THE ASSOCIATION OF PHYSICAL PLANT ADMINISTRATORS
OF UNIVERSITIES AND COLLEGES (APPA)
COMPUTERIZATION QUESTIONNAIRE RESPONDENT DATA

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|---|---|---|---|---|
| 0094 | MOORHEAD STATE UNIVERSITY<br>1104 7TH AVE. S.<br>MOORHEAD MINN<br>56560 | DUANE GRIER<br>(218)236-2156 | UNIVAC 1108<br>IBM UNDEFINED | PERSONNEL RECORDS<br>VACATN AND SICK LV RECDS<br>EQUIPMENT RECORDS<br>PURCHASE ORDERS<br>INVENTORY RECORDS |
| 0128 | MORAINE VALLEY COMMUNITY COLLEGE<br>PLANT OPERATIONS<br>10900 S. 88TH AVE<br>PALOS HILLS ILLINOIS<br>60465 | JOS. F. FERENCAK<br>(312)974-4300 | IBM 4341 | PAYROLL<br>PURCHASE ORDERS<br>INVENTORY RECORDS |
| 0269 | MORAVIAN COLLEGE<br>PHYSICAL PLANT DEPT<br>120 W. GREENWICH ST<br>BETHLEHEM PENNA<br>18018 | DOUGLAS J. PLOTTS<br>(215)861-1551 | | |
| 0263 | MOREHEAD STATE UNIVERSITY<br>OPERATIONS AND MAINTENANCE<br>UPO 831<br>MOREHEAD KENTUCKY<br>40351 | GLEN BOODRY<br>(606)783-2066 | | |
| 0073 | MOUNT ROYAL COLLEGE<br>PHYSICAL RESOURCES<br>4825 RICHARD ROAD S.W.<br>CALGARY ALBERTA<br>CANADA T3E6K6 | GARRY MORASH<br>(403)240-6417 | DEC 2060<br>DEC 1134 | PAYROLL<br>KEY RECORDS<br>PURCHASE ORDERS<br>INVENTORY RECORDS |
| 0305 | MUSKINGUM COLLEGE<br>PHYSICAL PLANT<br>COLLEGE DRIVE<br>NEW CONCORD OHIO<br>43762 | DAN YOUNG<br>(614)826-8161 | DEC VAX | PERSONNEL RECORDS<br>PAYROLL |
| 0383 | NORTH CARLOLINA STATE UNIVERSITY<br>PHYSICAL PLANT<br>P.O. BOX 19735-SHEPARD STATION<br>DURHAM N.CAROLINA<br>27607 | WILLIAM E. MCDONALD<br>(919)683-6392 | UNIVAC 9030-60 | PERSONNEL RECORDS<br>VACATN AND SICK LV RECDS<br>PAYROLL |

THE ASSOCIATION OF PHYSICAL PLANT ADMINISTRATORS
OF UNIVERSITIES AND COLLEGES (APPA)
COMPUTERIZATION QUESTIONNAIRE RESPONDENT DATA

PREPARED BY E G AND G INTERTECH — MAY 16, 1983 - 11 46 AM

| SER NUM | INSTITUTION | CONTACT PERSON | COMPUTER(S) IN USE | FUNCTIONS PERFORMED |
|---|---|---|---|---|
| 0033 | NORTH CAROLINA STATE UNIVERSITY<br>PHYSICAL PLANT DIVISION<br>P.O.BOX 5685<br>RALEIGH N.C.<br>27650 | CHARLES C. BRASWELL<br>(919)737-2967 | IBM 4341<br>APPLE II | PERSONNEL RECORDS<br>VACATN AND SICK LV RECDS<br>PAYROLL<br>PREVENTIVE MAINT SCHED<br>PROJECT SCHEDULING<br>PROJECT ORDER ISSUE<br>PROJECT COST REPORTING<br>PROJECT BILLING<br>EQUIPMENT RECORDS<br>PURCHASE ORDERS<br>INVENTORY RECORDS |
| 0164 | NORTH DAKOTA STATE UNIVERSITY<br>PHYSICAL PLANT DEPT<br>STATE UNIVERSITY STATION<br>FARGO N.DAKOTA<br>58105 | GARY C. REINKE<br>(701)237-7301 | IBM 4341<br>IBM 3780<br>IBM 370 158 | PERSONNEL RECORDS<br>VACATN AND SICK LV RECDS<br>PAYROLL<br>PREVENTIVE MAINT SCHED<br>PURCHASE ORDERS<br>INVENTORY RECORDS |
| 0129 | NORTH TEXAS STATE UNIVERSITY<br>PHYSICAL PLANT<br>P.O. BOX 13527<br>DENTON TEXAS<br>76203 | JAMES SIMPKINS<br>(817)565-2751 | TRS 80 M III | PERSONNEL RECORDS<br>VACATN AND SICK LV RECDS<br>PROJECT ESTIMATING<br>PROJECT ORDER ISSUE<br>PROJECT COST REPORTING<br>PROJECT BILLING<br>KEY RECORDS<br>INVENTORY RECORDS |
| 0261 | NORTHEASTERN UNIVERSITY<br>DEPT OF PHYSICAL PLANT<br>26 TAVERN ROAD<br>BOSTON MASS<br>02115 | THOMAS M. BRUNI<br>(617)437-2750 | DATAVIEW 80 | PERSONNEL RECORDS<br>VACATN AND SICK LV RECDS<br>PROJECT SCHEDULING<br>PROJECT ESTIMATING<br>PROJECT BILLING<br>KEY RECORDS<br>EQUIPMENT RECORDS<br>INVENTORY RECORDS |
| 0244 | NORTHERN MICHIGAN UNIVERSITY<br>PHYSICAL PLANT<br>PRESQUE ISLE AVE<br>MARQUETTE MICH<br>49855 | BRUCE N. RAUDIO<br>(906)227-2120 | IBM 4341 | PERSONNEL RECORDS<br>VACATN AND SICK LV RECDS<br>PAYROLL<br>EQUIPMENT RECORDS<br>PURCHASE ORDERS<br>INVENTORY RECORDS |

THE ASSCCIATION OF PHYSICAL PLANT ADMINISTRATORS
OF UNIVERSITIES AND COLLEGES (APPA)
COMPUTERIZATION QUESTIONNAIRE RESPONDENT DATA

PREPARED BY E G AND G INTERTECH — MAY 16, 1983 - 11 46 AM

| SER NUM | INSTITUTION | CONTACT PERSON | COMPUTER(S) IN USE | FUNCTIONS PERFORMED |
|---|---|---|---|---|
| 0227 | NORTHERN STATE COLLEGE<br>PHYSICAL PLANT<br>12TH AVE S.E. AND HAY ST.<br>ABERDEEN S.DAKOTA<br>57401 | RALPH JOHNSON<br>(605)622-2560 | IBM 3031 | PERSONNEL RECORDS<br>PAYROLL<br>INVENTORY RECORDS |
| 0387 | NORTHRN COL OF APPLD ARTS AND TECH<br>PLANT AND PROPERTY DEPT<br>P.O. BOX 2002<br>SOUTH PORCUPINEONTARIO<br>CANADA P0N1H0 | W.K. NEWELL<br>(705)235-3211 | TRS 80 M II | PROJECT SCHEDULING<br>PROJECT ESTIMATING<br>PROJECT ORDER ISSUE<br>PROJECT BILLING |
| 0293 | NORTHWESTERN UNIVERSITY<br>PHYSICAL PLANT<br>910 UNIVERSITY PLACE<br>EVANSTON ILLINOIS<br>60201 | ROLAND H. OLSON<br>(312)492-5205 | IBM P C | PERSONNEL RECORDS<br>KEY RECORDS |
| 0058 | NORWICH UNIVERSITY<br>COMPUTER SERVICES DEPT<br>NORTHFIELD VERMONT<br>05663 | DENIS G. STRATFORD<br>(802)485-5011 | | |
| 0371 | OAKLAND UNIVERSITY<br>UNIVERSITY ENGINEER<br>ROCHESTER MICH<br>48063 | GEORGE KARAS<br>(313)377-2160 | HONEYWELL DELTA 1000 | INVENTORY RECORDS |
| 0201 | OBERLIN COLLEGE<br>PHYSICAL PLANT<br>173 W. LORAIN ST<br>OBERLIN OHIO<br>44074 | JOE METRO<br>(216)775-8434 | IBM DISPLAYWRITER<br>IDS SUPERBRAIN II | PROJECT ORDER ISSUE<br>PURCHASE ORDERS |
| 0153 | OCCIDENTAL COLLEGE<br>PHYSICAL PLANT DEPT<br>1600 CAMPUS ROAD<br>LOS ANGELES CALIF<br>90041 | R.J. FARLEY<br>(213)259-2654 | IBM 360 | PAYROLL |
| 0297 | OHIO NORTHERN UNIVERSITY<br>DEPT OF PHYSICAL PLANT<br>WEST LINCOLN AVE<br>ADA OHIO<br>45810 | GEORGE T. SCHEID JR.<br>(419)772-2461 | DEC 1170 | PERSONNEL RECORDS<br>VACATN AND SICK LV RECDS<br>PAYROLL<br>PROJECT COST REPORTING<br>PURCHASE ORDERS |

THE ASSOCIATION OF PHYSICAL PLANT ADMINISTRATORS
OF UNIVERSITIES AND COLLEGES (APPA)
COMPUTERIZATION QUESTIONNAIRE RESPONDENT DATA

PREPARED BY E G AND G INTERTECH — MAY 16, 1983 - 11 46 AM

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|---|---|---|---|---|
| 0049 | OHIO STATE UNIVERSITY<br>DEPT OF PHYSICAL FACILITIES<br>2003 MILLIKIN ROAD<br>COLUMBUS OHIO<br>43210 | THOMAS B. SMITH<br>(614)422-7441 | AMDAHL 470<br>IBM P C | PERSONNEL RECORDS<br>VACATN AND SICK LV RECDS<br>PAYROLL<br>PREVENTIVE MAINT SCHED<br>PROJECT COST REPORTING<br>EQUIPMENT RECORDS |
| 0029 | OHIO UNIVERSITY<br>PHYSICAL PLANT DIVN<br>100 FACTORY STREET<br>ATHENS OHIO<br>45701 | WM. CHARLES CULP<br>(614)594-6413 | IBM 370 158<br>IBM P C | VACATN AND SICK LV RECDS<br>PAYROLL<br>PREVENTIVE MAINT SCHED<br>PROJECT SCHEDULING<br>PURCHASE ORDERS |
| 0369 | OKANAGAN COLLEGE<br>FACILITIES SERVICES<br>1000 K.L.O. ROAD<br>KELOWNA BRIT COLUMBIA<br>CANADA V1Y 4X8 | CHARLES PROKES<br>(604)762-5445 | DEC VAX | KEY RECORDS |
| 0017 | OKLAHOMA BAPTIST UNIVERSITY<br>PHYSICAL PLANT DEPT<br>500 W. UNIVERSITY<br>SHAWNEE OKLA<br>74801 | JOHNNY CULLISON<br>(405)275-2850 | HP3000 | PAYROLL |
| 0140 | OKLAHOMA STATE UNIVERSITY<br>PHYSICAL PLANT ADMINISTRATION<br>RM.103 PHYS PLANT ADMIN BLDG<br>STILLWATER OKLAHOMA<br>74078 | G.D. SHEPHERD<br>(405)372-1292 | IBM 3081 | PERSONNEL RECORDS<br>PAYROLL<br>INVENTORY RECORDS |
| 0068 | OREGON INSTITUTE OF TECHNOLOGY<br>PHYSICAL PLANT<br>ORETECH BRANCH P.O.<br>KLAMATH FALLS OREGON<br>97601 | R.E. WILTROUT<br>(503)882-6321 | | |

THE ASSOCIATION OF PHYSICAL PLANT ADMINISTRATORS
OF UNIVERSITIES AND COLLEGES (APPA)
COMPUTERIZATION QUESTIONNAIRE RESPONDENT DATA

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MAY 16, 1983 - 11 46 AM

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|---|---|---|---|---|
| 0350 | OREGON STATE UNIVERSITY<br>PHYSICAL PLANT<br>606 S.W. 15TH ST<br>CORVALLIS OREGON<br>97330 | RICHARD MUELLER<br>(503)754-4921 | HONEYWELL LEVEL 66<br>CDC CYBER 170<br>APPLE II | PERSONNEL RECORDS<br>VACATN AND SICK LV RECDS<br>PAYROLL<br>PREVENTIVE MAINT SCHED<br>PROJECT SCHEDULING<br>PROJECT ESTIMATING<br>PROJECT ORDER ISSUE<br>PROJECT COST REPORTING<br>PROJECT BILLING<br>EQUIPMENT RECORDS<br>PURCHASE ORDERS<br>INVENTORY RECORDS |
| 0209 | UTERO JUNIOR COLLEGE<br>PHYSICAL PLANT<br>18TH COLORADO<br>LA JUNTA COLORADO<br>81050 | KIP D. WALKER<br>(303)386-8721 | DEC PDP-11 | PAYROLL<br>PURCHASE ORDERS<br>INVENTORY RECORDS |
| 0188 | PAN AMERICAN UNIVERSITY<br>PHYSICAL PLANT DEPT<br>501 W. SUGAR RD<br>EDINBURG TEXAS<br>78539 | ELIGIO DELA CRUZ JR.<br>(512)381-2747 | DEC KL1091 | PROJECT COST REPORTING<br>PROJECT BILLING<br>INVENTORY RECORDS |
| 0101 | PELMAN COLLEGE<br>PHYSICAL FACILITIES<br>101 BALDWIN ST<br>CORPUS CHRISTI TEXAS<br>78404 | JESUS B. RODRIQUEZ<br>(512)881-6245 | TYPE NOT DEFINED | PREVENTIVE MAINT SCHED |
| 0401 | PENNSYLVANIA STATE UNIVERSITY<br>OFFICE OF PHYSICAL PLANT<br>401 OLD MAIN<br>UNIVERSITY PARKPENNA<br>16802 | NANCY M. STROUSE<br>(814)863-2149 | IBM 8100 | PERSONNEL RECORDS<br>VACATN AND SICK LV RECDS<br>PAYROLL<br>PREVENTIVE MAINT SCHED<br>PROJECT COST REPORTING<br>PROJECT BILLING<br>EQUIPMENT RECORDS<br>PURCHASE ORDERS |

THE ASSOCIATION OF PHYSICAL PLANT ADMINISTRATORS
OF UNIVERSITIES AND COLLEGES (APPA)
COMPUTERIZATION QUESTIONNAIRE RESPONDENT DATA

PREPARED BY E G AND G INTERTECH — MAY 16, 1983 - 11 46 AM

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|---|---|---|---|---|
| 0267 | PIEDMONT VA. COMMUNITY COLLEGE<br>PHYSICAL PLANT<br>RT 6 BOX 1A<br>CHARLOTTESVILLE VIRGINIA<br>22901 | PAUL ROOD<br>(804)977-3900 | APPLE II | PREVENTIVE MAINT SCHED<br>INVENTORY RECORDS |
| 0142 | POST COLLEGE INC.<br>TREASURERS<br>800 COUNTRY CLUB RD.<br>WATERBURY CONN<br>06702 | FRANK GOMES JR.<br>(203)755-0121 | DATA GENERAL NOVA 4X<br>TRS 80 M II | PERSONNEL RECORDS<br>VACATN AND SICK LV RECDS<br>PAYROLL<br>PURCHASE ORDERS |
| 0064 | PRATT INSTITUTE<br>PHYSICAL PLANT<br>379 DEKALB AVE<br>BROOKLYN N.Y.<br>11205 | A.P. STONE<br>(212)636-3579 | BURROUGHS 1726 | PAYROLL |
| 0205 | PRINCE GEORGES COMMUN COLLEGE<br>PHYSICAL PLANT DEPT<br>301 LARGO RD<br>UPPER MARLBORO MARYLAND<br>20772 | H. ALLEN STEARNS<br>(301)322-0655 | IBM 4341 | PERSONNEL RECORDS<br>VACATN AND SICK LV RECDS<br>PAYROLL<br>INVENTORY RECORDS |
| 0237 | PRINCETON UNIVERSITY<br>BUSINESS OFFICE<br>MACMILLAN BLDG<br>PRINCETON N.J.<br>08544 | | IBM 3081 | PAYROLL<br>PROJECT COST REPORTING |
| 0076 | PRINCIPIA COLLEGE<br>PHYSICAL PLANT<br>ELSAH ILLINOIS<br>62028 | GILBERT C. IVES<br>(618)374-2131 | HP3000 | PREVENTIVE MAINT SCHED |
| 0270 | PURDUE UNIVERSITY-NORTH CENTRAL<br>PHYSICAL PLANT<br>WESTVILLE INDIANA<br>46391 | T. NELSON<br>(219)785-2541 | IBM SYSTEM 34 | KEY RECORDS |

THE ASSOCIATION OF PHYSICAL PLANT ADMINISTRATORS
OF UNIVERSITIES AND COLLEGES (APPA)
COMPUTERIZATION QUESTIONNAIRE RESPONDENT DATA

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| SER NUM | INSTITUTION | CONTACT PERSON | COMPUTER(S) IN USE | FUNCTIONS PERFORMED |
|---|---|---|---|---|
| 0020 | RADFORD UNIVERSITY<br>DIRECTOR OF PHYSICAL PLANT<br>P.O.BOX 5580<br>RADFORD VIRGINIA<br>24142 | DAVID ARMSTRONG<br>(703)731-5346 | HP 300 | PROJECT COST REPORTING<br>PROJECT BILLING |
| 0236 | RENSSELAER POLYTECHNIC INSTITUTE<br>PHYSICAL FACILITIES<br>110 EIGHTH ST<br>TROY N.Y.<br>12181 | JOHN H. GROSVENOR<br>(518)270-6295 | IBM 3033 | PREVENTIVE MAINT SCHED<br>PROJECT ORDER ISSUE<br>INVENTORY RECORDS |
| 0183 | RICKS COLLEGE<br>BLDG 82<br>REXBURG IDAHO<br>83440 | CHUCK FROST<br>(208)356-2656 | IBM SYSTEM 38 | PERSONNEL RECORDS<br>VACATN AND SICK LV RECDS<br>PAYROLL<br>PROJECT COST REPORTING<br>PROJECT BILLING<br>PURCHASE ORDERS<br>INVENTORY RECORDS |
| 0238 | RIDER COLLEGE<br>FACILITIES ENGINEERING<br>P.O. BOX 6400<br>LAWRENCEVILLE N.J.<br>08648 | THOMPSON W. LOE<br>(609)896-1410 | | |
| 0393 | ROANOKE COLLEGE<br>BUSINESS AFFAIRS<br>SALEM VIRGINIA<br>24153 | WILLIAM R. WALTON<br>(703)389-2351 | MICRO-DATA 6000<br>TIME SHARING | PAYROLL<br>PREVENTIVE MAINT SCHED<br>KEY RECORDS<br>EQUIPMENT RECORDS<br>INVENTORY RECORDS |
| 0041 | ROCHESTER INSTITUTE OF TECHNOLOGY<br>PHYSICAL PLANT<br>ONE LOMB MEMORIAL DRIVE<br>ROCHESTER N.Y.<br>14623 | WILLIAM H. METS<br>(716)475-2050 | IBM 370<br>DEC VAX<br>IBM P C | PAYROLL<br>PREVENTIVE MAINT SCHED<br>PROJECT ORDER ISSUE<br>PROJECT COST REPORTING<br>KEY RECORDS<br>EQUIPMENT RECORDS<br>INVENTORY RECORDS |

THE ASSOCIATION OF PHYSICAL PLANT ADMINISTRATORS
OF UNIVERSITIES AND COLLEGES (APPA)
COMPUTERIZATION QUESTIONNAIRE RESPONDENT DATA

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|---|---|---|---|---|
| 0276 | ROCKFORD COLLEGE<br>PHYSICAL PLANT<br>5050 E. STATE<br>ROCKFORD ILLINOIS<br>61101 | | BARBER COLEMAN ECON IV | PAYROLL<br>PREVENTIVE MAINT SCHED<br>KEY RECORDS |
| 0110 | SAINT ANSELM COLLEGE<br>MAINTENANCE DEPT<br>ST. ANSELMS DRIVE<br>MANCHESTER NEW HAMPSHIRE<br>03102 | REV. CECIL DONAHUE<br>(603)669-1030 | IBM SYSTEM 34 | PERSONNEL RECORDS<br>PAYROLL |
| 0333 | SAINT EDWARDS UNIVERSITY<br>PHYSICAL PLANT<br>3001 S. CONGRESS AVE<br>AUSTIN TEXAS<br>78704 | J.J. FLETCHER<br>(512)444-2621 | DEC PDP-11 | PAYROLL |
| 0339 | SAM HOUSTON STATE UNIVERSITY<br>PHYSICAL PLANT<br>BOX 2357<br>HUNTSVILLE TEXAS<br>77341 | D.R. HINES<br>(713)294-1866 | DEC UNDEFINED | PERSONNEL RECORDS<br>VACATN AND SICK LV RECDS<br>PAYROLL |
| 0329 | SAN DIEGO STATE UNIVERSITY<br>PHYS PLANT-WORK CONTROL CNTR<br>SAN DIEGO CALIF | STEVE SCHATELE<br>(619)265-4755 | DEC 1140<br>REXON 30 | VACATN AND SICK LV RECDS<br>PREVENTIVE MAINT SCHED<br>PROJECT SCHEDULING<br>PROJECT ORDER ISSUE<br>KEY RECORDS |
| 0229 | SAN FRANCISCO STATE UNIVERSITY<br>DEPT OF PLANT OPERATIONS<br>1600 HOLLOWAY AVE<br>SAN FRANCISCO CALIF<br>94132 | DAVID R. HOWARD<br>(415)469-1360 | REXON 30<br>CDC CYBER | PREVENTIVE MAINT SCHED<br>KEY RECORDS |
| 0382 | SANGAMON STATE UNIVERSITY<br>PHYSICAL PLANNING AND OPERATIONS<br>SHEPHERD ROAD<br>SPRINGFIELD ILLINOIS<br>62708 | RICHARD R. WILLIAMS<br>(217)786-6530 | HP3000 | KEY RECORDS<br>INVENTORY RECORDS |

THE ASSOCIATION OF PHYSICAL PLANT ADMINISTRATORS
OF UNIVERSITIES AND COLLEGES (APPA)
COMPUTERIZATION QUESTIONNAIRE RESPONDENT DATA

PREPARED BY E G AND G INTERTECH — MAY 16, 1983 - 11 46 AM

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|---|---|---|---|---|
| 0249 | SANTA FE COMMUNITY COLLEGE<br>GRNDS DEPT/PHYSICAL PLANT<br>3000 NW 83RD ST<br>GAINESVILLE FLORIDA<br>33601 | C.B. ZELLERMAYER<br>(904)377-5161 | APPLE III | PREVENTIVE MAINT SCHED<br>EQUIPMENT RECORDS |
| 0012 | SHIPPENSBURG STATE COLLEGE<br>DIRECTOR OF PHYSICAL PLANT<br>BOX 503-SHIPPENSBURG STATE COLLEGE<br>SHIPPENSBURG PENNA<br>17257 | WALTER R. PLEDGER<br>(717)532-1451 | UNIVAC 90/70 | PROJECT ORDER ISSUE<br>PROJECT COST REPORTING |
| 0288 | SIMMONS COLLEGE<br>MGR OF RESIDENCE FACILITIES<br>321 BROOKLINE AVE<br>BOSTON MASS<br>02115 | WILLIAM F. GRINDL<br>(617)738-2249 | | |
| 0008 | SIMON FRASER UNIVERSITY<br>PHYS PLANT AND PLANNING DEPT<br>BURNABY 2<br>BURNABY 2 BRITISH COLUMBI<br>CANADA V5A1S6 | CALEN GAINE<br>(604)291-4172 | IBM 4341 | PERSONNEL RECORDS<br>VACATN AND SICK LV RECDS<br>PAYROLL<br>PREVENTIVE MAINT SCHED<br>PROJECT SCHEDULING<br>PROJECT COST REPORTING<br>PROJECT BILLING<br>INVENTORY RECORDS |
| 0346 | SMITHSONIAN INSTITUTION<br>OFFICE OF PLANT SERVICES<br>10TH AND CONSTITUTION AVE N.W.<br>WASHINGTON D.C.<br>20560 | MICHAEL J. SOFIELD<br>(202)357-1665 | HONEYWELL LEVEL 66<br>IBM SERIES I M54 | PERSONNEL RECORDS<br>VACATN AND SICK LV RECDS<br>PAYROLL<br>PREVENTIVE MAINT SCHED<br>PROJECT SCHEDULING<br>PROJECT COST REPORTING<br>PURCHASE ORDERS<br>INVENTORY RECORDS |
| 0221 | SO EASTERN MASSACHUSETTS UNIVERSITY<br>OFFICE OF PLANNING AND PLANT<br>OLD WESTPORT RD.<br>N. DARTMOUTH MASS<br>02747 | F. JACOBS<br>(617)999-8100 | DEC 20<br>BARBER COLEMAN ECON IV | PERSONNEL RECORDS<br>VACATN AND SICK LV RECDS<br>PAYROLL<br>PREVENTIVE MAINT SCHED |

132

93

THE ASSOCIATION OF PHYSICAL PLANT ADMINISTRATORS
OF UNIVERSITIES AND COLLEGES (APPA)
COMPUTERIZATION QUESTIONNAIRE RESPONDENT DATA

PREPARED BY E G AND G INTERTECH — MAY 16, 1983 - 11 46 AM

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|---|---|---|---|---|
| 0150 | SONOMA COUNTY JR. COLLEGE DIST.<br>SANTA ROSA JR COLLEGE BLDGS/GRNDS D<br>1501 MENDOCINO AVE<br>SANTA ROSA CALIF<br>95401 | LARRY BOURGET<br>(707)527-4231 | HP3000 | PERSONNEL RECORDS<br>VACATN AND SICK LV RECDS<br>PAYROLL<br>PROJECT BILLING<br>PURCHASE ORDERS<br>INVENTORY RECORDS |
| 0303 | SOUTHERN BAPTIST THEOLOGCL SEMINARY<br>FACILITIES PLANNING AND MGMT<br>2825 LEXINGTON ROAD<br>LOUISVILLE KENTUCKY<br>40280 | H. DAVIS BYRD<br>(502)897-4103 | TYPE NOT DEFINED | PERSONNEL RECORDS<br>VACATN AND SICK LV RECDS<br>PAYROLL<br>PURCHASE ORDERS<br>INVENTORY RECORDS |
| 0135 | SOUTHERN ILLINOIS UNIV-CARBONDALE<br>PHYSICAL PLANT<br>CARBONDALE ILLINOIS<br>62901 | DALE W. REIMAN<br>(618)453-4371 | IBM 4341 | PERSONNEL RECORDS<br>VACATN AND SICK LV RECDS<br>PAYROLL<br>PROJECT ORDER ISSUE<br>PROJECT COST REPORTING<br>PROJECT BILLING<br>EQUIPMENT RECORDS<br>PURCHASE ORDERS |
| 0304 | SOUTHWEST TEXAS STATE UNIVERSITY<br>PHYSICAL PLANT<br>SAN MARCOS TEXAS<br>78666 | ROBERT PATTEE<br>(512)245-2242 | DEC 10 | PERSONNEL RECORDS<br>VACATN AND SICK LV RECDS<br>PAYROLL<br>PREVENTIVE MAINT SCHED<br>PROJECT SCHEDULING<br>PROJECT ESTIMATING<br>PROJECT ORDER ISSUE<br>PROJECT COST REPORTING<br>PROJECT BILLING<br>KEY RECORDS<br>EQUIPMENT RECORDS<br>PURCHASE ORDERS<br>INVENTORY RECORDS |
| 0308 | SOUTHWESTERN AT MEMPHIS<br>ADMINISTRATIVE SERVICES<br>2000 N. PARKWAY<br>MEMPHIS TENN<br>38112 | THOMAS R. KEPPLE JR.<br>(901)274-1800 | DEC VAX | PERSONNEL RECORDS<br>VACATN AND SICK LV RECDS<br>PAYROLL<br>PROJECT BILLING<br>KEY RECORDS<br>INVENTORY RECORDS |

THE ASSOCIATION OF PHYSICAL PLANT ADMINISTRATORS
OF UNIVERSITIES AND COLLEGES (APPA)
COMPUTERIZATION QUESTIONNAIRE RESPONDENT DATA

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| 0253 | SPRINGFIELD COLLEGE<br>PHYSICAL PLANT DEPT<br>263 ALDEN ST<br>SPRINGFIELD MASS<br>01109 | STEPHEN KEITH<br>(413)788-3252 | IBM SYSTEM 3 | PAYROLL<br>PURCHASE ORDERS |
| 0345 | STANFORD UNIV MEDICAL CENTER<br>FACILITIES<br>700 WELCH RD-STANFORD BARN<br>STANFORD CALIF<br>94305 | KENNETH THOMPSON<br>(415)497-5169 | IBM 3081 | PERSONNEL RECORDS<br>VACATN AND SICK LV RECDS<br>PAYROLL<br>PREVENTIVE MAINT SCHED<br>PROJECT SCHEDULING<br>PROJECT ORDER ISSUE<br>PROJECT COST REPORTING<br>PROJECT BILLING<br>EQUIPMENT RECORDS<br>PURCHASE ORDERS |
| 0077 | STATE UNIV AND COMTY COL SYS OF TEN<br>STATE BOARD OF REGENTS<br>1161 MURFREESBORO ROAD<br>NASHVILLE TENN<br>37217 | RICHARD H. SCHELLHARDT<br>(615)741-4821 | | |
| 0082 | STATE UNIV OF N Y AT PLATTSBURGH<br>PHYSICAL PLANT<br>SERVICE/ADMIN BLDGS<br>PLATTSBURGH N.Y.<br>12901 | M.S.CULLIN/D.ALLAN<br>(518)564-3078 | TYPE NOT DEFINED | PERSONNEL RECORDS<br>VACATN AND SICK LV RECDS<br>PAYROLL |
| 0281 | STATE UNIV OF N.Y. AT ONEONTA<br>DIRECTOR OF PHYSICAL PLANT<br>ADMINISTRATION BLDG<br>ONEONTA N.Y.<br>13820 | HERBERT SELIGMAN<br>(607)431-3343 | | |
| 0286 | STEVEN INSTITUTE<br>PHYSICAL PLANT DEPT<br>CASTLE PT. STATION<br>HOBOKEN N.J.<br>07030 | BILL CRISMAN<br>(201)420-5272 | DEC UNDEFINED<br>HONEYWELL DELTA 1000 | PERSONNEL RECORDS<br>VACATN AND SICK LV RECDS<br>PAYROLL<br>PREVENTIVE MAINT SCHED |

THE ASSOCIATION OF PHYSICAL PLANT ADMINISTRATORS
OF UNIVERSITIES AND COLLEGES (APPA)
COMPUTERIZATION QUESTIONNAIRE RESPONDENT DATA

PREPARED BY E G AND G INTERTECH — MAY 16, 1983 - 11 46 AM

| SER NUM | INSTITUTION | CONTACT PERSON | COMPUTER(S) IN USE | FUNCTIONS PERFORMED |
|---|---|---|---|---|
| 0185 | ST. LOUIS COMMUNITY COLLEGE<br>COORD OF PHYSICAL FACILITIES<br>5801 WILSON AVE<br>ST. LOUIS MISSOURI<br>63110 | ROGER BRENDECKE<br>(314)644-9621 | TIME SHARING | PERSONNEL RECORDS<br>VACATN AND SICK LV RECDS<br>PAYROLL |
| 0193 | ST. OLAF COLLEGE<br>PHYSICAL PLANT DEPT<br>NORTHFIELD MINN<br>55057 | NORMAN E. MADSON<br>(507)663-3280 | TRAIN SENT TRACER 1000 | PERSONNEL RECORDS |
| 0089 | ST. PETERSBURG JUNIOR COLLEGE<br>PHYSICAL PLANT<br>P.O. BOX 13489<br>ST. PETERSBURG FLORIDA<br>33733 | LEON J. COONING<br>(813)526-2794 | BURROUGHS 2930 | PERSONNEL RECORDS<br>PAYROLL<br>INVENTORY RECORDS |
| 0367 | SUNY UPSTATE MEDICAL CENTER<br>750 E. ADAMS ST.<br>SYRACUSE N.Y.<br>13210 | DONALD L. SNYDER<br>(715)473-4448 | HONEYWELL DPS-8<br>IBM 370<br>TRS 80 M 1 | VACATN AND SICK LV RECDS<br>PAYROLL<br>PREVENTIVE MAINT SCHED<br>PROJECT COST REPORTING<br>KEY RECORDS<br>EQUIPMENT RECORDS<br>PURCHASE ORDERS |
| 0301 | S.DAK SCH OF MINES AND TECHNOLOGY<br>PHYSICAL PLANT<br>500 E. ST JOSEPH<br>RAPID CITY S.DAKOTA<br>57701 | RONALD F. GRAY<br>(605)394-2251 | CDC UNDEFINED | VACATN AND SICK LV RECDS<br>PAYROLL<br>KEY RECORDS<br>PURCHASE ORDERS<br>INVENTORY RECORDS |
| 0207 | S.E. MISSOURI STATE UNIVERSITY<br>PHYSICAL PLANT OFFICE<br>900 NORMAL ST<br>CAPE GIRARDEAU MISSOURI<br>63701 | VINCE SEYER<br>(334)651-2214 | IBM 4341 | PROJECT ORDER ISSUE<br>PROJECT COST REPORTING<br>EQUIPMENT RECORDS |
| 0283 | TEMPLE JUNIOR COLLEGE<br>BUSINESS OFFICE<br>2600 S. FIRST ST.<br>TEMPLE TEXAS<br>76501 | PERCY A. FRANCIS<br>(817)775-9961 | IBM 370-115 | PAYROLL<br>EQUIPMENT RECORDS<br>PURCHASE ORDERS |

THE ASSOCIATION OF PHYSICAL PLANT ADMINISTRATORS
OF UNIVERSITIES AND COLLEGES (APPA)
COMPUTERIZATION QUESTIONNAIRE RESPONDENT DATA

PREPARED BY E G AND G INTERTECH — MAY 16, 1983 - 11 46 AM

| SER NUM | INSTITUTION | CONTACT PERSON | COMPUTER(S) IN USE | FUNCTIONS PERFORMED |
|---|---|---|---|---|
| 0356 | TEXAS A+M UNIVERSITY<br>PHYSICAL PLANT<br>600 UNIVERSITY AVE<br>COLLEGE STATION TEXAS<br>77843 | L.R. JOHNSON<br>(713)845-1647 | AMDAHL 470 | PERSONNEL RECORDS<br>PAYROLL<br>PREVENTIVE MAINT SCHED<br>PROJECT COST REPORTING<br>PROJECT BILLING<br>EQUIPMENT RECORDS<br>INVENTORY RECORDS |
| 0348 | TEXAS CHRISTIAN UNIVERSITY<br>DEPT OF PHYSICAL PLANT<br>BOX 30786<br>FT. WORTH TEXAS<br>76129 | CHARLES THOMAS<br>(817)921-7955 | TYPE NOT DEFINED | PROJECT SCHEDULING<br>PROJECT ESTIMATING<br>PROJECT COST REPORTING<br>INVENTORY RECORDS |
| 0358 | TEXAS TECH UNIV HEALTH SCI CENTER<br>PLANT OPERATIONS DEPT<br>3601 4TH STREET<br>LUBBOCK TEXAS<br>79430 | ROY B.LEMASTER<br>(806)743-2070 | IBM 4341 | PERSONNEL RECORDS<br>VACATN AND SICK LV RECDS<br>PAYROLL<br>PREVENTIVE MAINT SCHED<br>PROJECT SCHEDULING |
| 0168 | TEXAS TECH UNIVERSITY<br>BLDG MAINTENANCE AND UTILITIES DEPT<br>P.O. BOX 4219<br>LUBBOCK TEXAS<br>79409 | W.D.(BILL) GLAZEBROOK<br>(806)742-1692 | TYPE NOT DEFINED | PREVENTIVE MAINT SCHED<br>INVENTORY RECORDS |
| 0322 | THE COLLEGE OF ST. CATHERINE<br>PHYSICAL PLANT<br>2004 RANDOLPH<br>ST. PAUL MINN<br>55105 | F. (BUD) KEETLEY<br>(612)690-6745 | TYPE NOT DEFINED | PERSONNEL RECORDS<br>PREVENTIVE MAINT SCHED<br>EQUIPMENT RECORDS |
| 0048 | THE ENERGY RESOURCES MANAGEMENT CO.<br>P.O. BOX 1515<br>MADISON CONN.<br>06443 | DAVID NEWTON<br>(203)245-9600 | TRS 80 M III | PAYROLL<br>PREVENTIVE MAINT SCHED<br>PROJECT SCHEDULING<br>PROJECT COST REPORTING<br>PURCHASE ORDERS<br>INVENTORY RECORDS |
| 0125 | THE EVERGREEN STATE COLLEGE<br>FACILITIES<br>OLYMPIA WASH<br>98505 | RON WILKINSON<br>(206)866-6000 | TIME SHARING | PAYROLL<br>KEY RECORDS<br>PURCHASE ORDERS<br>INVENTORY RECORDS |

THE ASSOCIATION OF PHYSICAL PLANT ADMINISTRATORS
OF UNIVERSITIES AND COLLEGES (APPA)
COMPUTERIZATION QUESTIONNAIRE RESPONDENT DATA

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MAY 16, 1983 - 11 46 AM

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|---|---|---|---|---|
| 0226 | THE JOHNS HOPKINS UNIVERSITY<br>PLANT OPERATIONS DEPT<br>3400 N. CHARLES ST<br>BALTIMORE MARYLAND<br>21218 | LOUIS P. HEHL<br>(301)338-8060 | | |
| 0319 | THE UNIVERSITY OF MICHIGAN<br>PLANT OPERATIONS<br>326 E. HOOVER<br>ANN ARBOR MICH<br>48109 | M.H. VAN DER KOOY<br>(313)763-5125 | NCR 8555 | PERSONNEL RECORDS<br>VACATN AND SICK LV RECDS<br>PAYROLL<br>PROJECT ORDER ISSUE<br>PROJECT COST REPORTING<br>PROJECT BILLING<br>KEY RECORDS<br>PURCHASE ORDERS |
| 0232 | TRINITY COLLEGE<br>PHYSICAL PLANT<br>208 COLCHESTER AVE<br>BURLINGTON VERMONT<br>05401 | WM RUBENSTEIN<br>(802)658-0337 | | |
| 0151 | TRITON COLLEGE<br>MAINTENANCE AND OPERATIONS<br>2000 FIFTH AVENUE<br>RIVER GROVE ILLINOIS<br>60171 | FRANK UITVLUGT<br>(312)456-0300 | BURROUGHS 7000 | PERSONNEL RECORDS<br>VACATN AND SICK LV RECDS<br>PAYROLL<br>PURCHASE ORDERS<br>INVENTORY RECORDS |
| 0081 | TULANE MEDICAL CENTER<br>MAINTENANCE AND OPERATIONS<br>1430 TULANE AVENUE<br>NEW ORLEANS LOUISIANA<br>70112 | R.D. RATAGICH<br>(504)588-2272 | WANG | PERSONNEL RECORDS<br>VACATN AND SICK LV RECDS<br>PAYROLL<br>PREVENTIVE MAINT SCHED<br>PROJECT SCHEDULING<br>PROJECT ESTIMATING<br>PROJECT ORDER ISSUE<br>PROJECT COST REPORTING<br>PROJECT BILLING<br>KEY RECORDS<br>EQUIPMENT RECORDS<br>PURCHASE ORDERS<br>INVENTORY RECORDS |

THE ASSOCIATION OF PHYSICAL PLANT ADMINISTRATORS
OF UNIVERSITIES AND COLLEGES (APPA)
COMPUTERIZATION QUESTIONNAIRE RESPONDENT DATA

PREPARED BY E G AND G INTERTECH — MAY 16, 1983 - 11 46 AM

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|---|---|---|---|---|
| 0030 | TULANE UNIVERSITY<br>PHYSICAL PLANT<br>6823 ST.CHARLES AVENUE<br>NEW ORLEANS LOUISIANA<br>70118 | CHARLES GILBERT<br>(604)865-5441 | ATS IMS 8520H | PREVENTIVE MAINT SCHED<br>PROJECT SCHEDULING<br>PROJECT ORDER ISSUE<br>EQUIPMENT RECORDS |
| 0130 | UNIV OF ARKANSAS FOR MED SCIENCE<br>CAMPUS OPERATIONS<br>4301 WEST MARKHAM<br>LITTLE ROCK ARKANSAS<br>72205 | MICHAEL J. DWYER JR.<br>(501)661-5683 | TYPE NOT DEFINED | VACATN AND SICK LV RECDS<br>PREVENTIVE MAINT SCHED<br>PROJECT ESTIMATING<br>PROJECT COST REPORTING<br>PROJECT BILLING<br>EQUIPMENT RECORDS |
| 0211 | UNIV OF CENTRAL ARKANSAS<br>PHYSICAL PLANT<br>BRUCE AND DONAGHEY STS<br>CONWAY ARKANSAS<br>70232 | L.R. PLUMMER<br>(501)450-3196 | | |
| 0344 | UNIV OF ILLINOIS AT CHICAGO<br>FACILITIES MANAGEMENT<br>1140 S. MORGAN<br>CHICAGO ILLINOIS<br>60680 | FRANK C. FERET<br>(312)996-5160 | TRS 80 M 16<br>IBM 370 | PERSONNEL RECORDS<br>VACATN AND SICK LV RECDS<br>PAYROLL<br>PROJECT SCHEDULING<br>PROJECT ESTIMATING<br>PROJECT ORDER ISSUE<br>PROJECT COST REPORTING<br>PROJECT BILLING<br>KEY RECORDS<br>EQUIPMENT RECORDS<br>PURCHASE ORDERS<br>INVENTORY RECORDS |
| 0189 | UNIV OF ILL. COLL OF MEDICINE<br>PLANT OPERATIONS<br>1601 PARKVIEW AVE<br>ROCKFORD ILLINOIS<br>61101 | PAUL E. DIXON<br>(815)987-7276 | | |
| 0194 | UNIV OF MEDICN AND DENTSTRY OF N J<br>PHYSICAL PLANT<br>100 BERGEN ST<br>NEWARK N.J.<br>07103 | GERALD MILLER<br>(201)456-4337 | IBM 4341 | PERSONNEL RECORDS<br>VACATN AND SICK LV RECDS<br>PAYROLL<br>PREVENTIVE MAINT SCHED<br>PROJECT SCHEDULING<br>PROJECT COST REPORTING |

66

THE ASSOCIATION OF PHYSICAL PLANT ADMINISTRATORS
OF UNIVERSITIES AND COLLEGES (APPA)
COMPUTERIZATION QUESTIONNAIRE RESPONDENT DATA

PREPARED BY E G AND G INTERTECH — MAY 16, 1983 - 11 46 AM

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|---|---|---|---|---|
| 0273 | UNIV OF MICHIGAN-DEARBORN<br>FACILITIES MANAGEMENT<br>4901 EVERGREEN RD<br>DEARBORN MICH<br>48128 | R. BABIARZ<br>(313)593-5380 | IBM 3031<br>HP 300 | PERSONNEL RECORDS<br>PAYROLL<br>PROJECT BILLING<br>PURCHASE ORDERS |
| 0368 | UNIV OF NEBRASKA-LINCOLN<br>PHYSICAL PLANT ADMIN<br>1700 'Y' STREET<br>LINCOLN NEBRASKA<br>68588 | JIM HINES<br>(402)472-3131 | | |
| 0331 | UNIV OF NEVADA-LAS VEGAS<br>PHYSICAL PLANT<br>4505 MARYLAND PKWY<br>LAS VEGAS NEVADA<br>89154 | CHAS MOODY<br>(702)739-3281 | CDC UNDEFINED<br>APPLE II | PERSONNEL RECORDS<br>VACATN AND SICK LV RECDS<br>PAYROLL<br>PREVENTIVE MAINT SCHED<br>KEY RECORDS |
| 0361 | UNIV OF NEVADA-RENO<br>PHYSICAL PLANT DEPT<br>PHYSICAL PLANT DEPT<br>RENO NEVADA<br>89557 | BUZZ NELSON<br>(702)784-6514 | CDC UNDEFINED | KEY RECORDS |
| 0268 | UNIV OF RICHMOND<br>PHYSICAL PLANT<br><br>RICHMOND VIRGINIA<br>23173 | DONALD PICKARD<br>(804)285-6351 | IBM P C<br>TRS 80 M 1 | PERSONNEL RECORDS<br>PREVENTIVE MAINT SCHED<br>PROJECT ORDER ISSUE<br>PROJECT COST REPORTING<br>PROJECT BILLING<br>EQUIPMENT RECORDS<br>INVENTORY RECORDS |
| 0302 | UNIV OF SOUTHERN MISSISSIPPI<br>PHYSICAL PLANT DIVN<br>P.O. BOX 5058<br>HATTIESBURG MISS<br>39406 | H. GENE HENDERSON<br>(601)266-4414 | XEROX SIGMA 9 | PERSONNEL RECORDS<br>VACATN AND SICK LV RECDS<br>PAYROLL |
| 0325 | UNIV OF TENNESSEE AT MARTIN<br>FACILITIES PLANNING<br>318 ADMIN BLDG-UT**MARTIN<br>MARTIN TENNESSEE<br>38238 | ED N. WHITE<br>(901)587-7601 | DEC 1170 | EQUIPMENT RECORDS |

THE ASSOCIATION OF PHYSICAL PLANT ADMINISTRATORS
OF UNIVERSITIES AND COLLEGES (APPA)
COMPUTERIZATION QUESTIONNAIRE RESPONDENT DATA

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MAY 16, 1983 - 11 46 AM

| SER NUM | INSTITUTION | CONTACT PERSON | COMPUTER(S) IN USE | FUNCTIONS PERFORMED |
|---|---|---|---|---|
| 0392 | UNIV OF TENN-CENTER FOR HEALTH SCI<br>OFFICE OF FACILITIES MGMT<br>800 MADISON AVE<br>MEMPHIS TENN<br>38163 | HOWARD CARMAN<br>(901)528-5507 | DEC 1170 | PROJECT COST REPORTING<br>PROJECT BILLING |
| 0385 | UNIV OF TEX HEALTH SCI CNTR, DALLAS<br>PHYSICAL PLANT DEPT<br>5323 HARRY HINES BLVD<br>DALLAS TEXAS<br>75235 | JOAN PICKARD<br>(214)688-3161 | TYPE NOT DEFINED | PROJECT ORDER ISSUE<br>INVENTORY RECORDS |
| 0163 | UNIV OF TEXAS HEALTH SCIENCE CENTER<br>PHYSICAL PLANT<br>7703 FLOYD CURL DRIVE<br>SAN ANTONIO TEXAS<br>78284 | RALPH YARBROUGH<br>(512)691-6241 | DEC 2060<br>DEC 1134 | PERSONNEL RECORDS<br>VACATN AND SICK LV RECDS<br>PAYROLL<br>PREVENTIVE MAINT SCHED<br>PROJECT SCHEDULING<br>PROJECT ORDER ISSUE<br>INVENTORY RECORDS |
| 0102 | UNIV OF WEST FLORIDA<br>PHYSICAL PLANT<br>BLDG 53<br>PENSACOLA FLORIDA<br>32514 | JIM HENRY<br>(904)474-2906 | IBM 3081 | PERSONNEL RECORDS<br>VACATN AND SICK LV RECDS<br>PAYROLL<br>PROJECT SCHEDULING<br>PROJECT COST REPORTING<br>KEY RECORDS<br>PURCHASE ORDERS<br>INVENTORY RECORDS |
| 0323 | UNIV OF WISCONSIN-EAU CLAIRE<br>FACILITIES MGMT<br>105 GARFIELD AVE<br>EAU CLAIRE WISCONSIN<br>54701 | RUDY POLENZ<br>(715)836-3361 | BURROUGHS 3950 | PERSONNEL RECORDS<br>VACATN AND SICK LV RECDS<br>PAYROLL<br>PROJECT ORDER ISSUE<br>PROJECT COST REPORTING<br>PROJECT BILLING<br>EQUIPMENT RECORDS<br>INVENTORY RECORDS |

THE ASSOCIATION OF PHYSICAL PLANT ADMINISTRATORS
OF UNIVERSITIES AND COLLEGES (APPA)
COMPUTERIZATION QUESTIONNAIRE RESPONDENT DATA

PREPARED BY E G AND G INTERTECH — MAY 16, 1983 - 11 46 AM

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|---|---|---|---|---|
| 0374 | UNIV OF WISCONSIN-MILWAUKEE<br>PHYSICAL PLANT SVCS-ADMINISTRATION<br>P.O. BOX 413<br>MILWAUKEE WISCONSIN<br>53201 | CHRIS INKMANN<br>(414)963-6284 | IBM 370<br>MICRO-DATA 6000 | PERSONNEL RECORDS<br>VACATN AND SICK LV RECDS<br>PAYROLL<br>PROJECT ESTIMATING<br>PROJECT ORDER ISSUE<br>PROJECT COST REPORTING<br>PROJECT BILLING<br>KEY RECORDS<br>PURCHASE ORDERS<br>INVENTORY RECORDS |
| 0257 | UNIV OF WISCONSIN-PLATTEVILLE<br>PHYSICAL PLANT<br>PLATTEVILLE WISCONSIN<br>53818 | JIM VALASKEY<br>(608)342-1177 | HONEYWELL DPS-8 | PREVENTIVE MAINT SCHED |
| 0277 | UNIV OF WISCONSIN-WHITEWATER<br>GENERAL SERVICES<br>500 N. FREMONT ROAD<br>WHITEWATER WISCONSIN<br>53190 | DEAN W. WOLF<br>(414)472-1016 | | |
| 0204 | UNIVERSIDAD DEL TURABO<br>DEAN OF ADMINISTRATION<br>P.O. BOX 1091<br>CAGUAS<br>PUERTO RICO 00625 | GREGORIO VASQUEZ<br>(809)743-7979 | TYPE NOT DEFINED | PAYROLL |
| 0019 | UNIVERSITY OF ALASKA<br>PHYSICAL PLANT<br>11120 GLACIER HIGHWAY<br>JUNEAU ALASKA<br>99801 | ROBERT L. GREEN<br>(907)789-4496 | HONEYWELL LEVEL 66<br>HP3000<br>IBM P C | PERSONNEL RECORDS<br>VACATN AND SICK LV RECDS<br>PAYROLL<br>KEY RECORDS<br>PURCHASE ORDERS<br>INVENTORY RECORDS |
| 0039 | UNIVERSITY OF ALASKA-ANCHORAGE<br>PHYSICAL PLANT<br>3211 PROVIDENCE<br>ANCHORAGE ALASKA<br>99508 | FRED JANVRIN<br>(907)263-1111 | APPLE II | VACATN AND SICK LV RECDS<br>PREVENTIVE MAINT SCHED<br>EQUIPMENT RECORDS<br>INVENTORY RECORDS |

THE ASSOCIATION OF PHYSICAL PLANT ADMINISTRATORS
OF UNIVERSITIES AND COLLEGES (APPA)
COMPUTERIZATION QUESTIONNAIRE RESPONDENT DATA

PREPARED BY E G AND G INTERTECH — MAY 16, 1983 - 11 46 AM

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|---|---|---|---|---|
| 0131 | UNIVERSITY OF ARK AT LITTLE ROCK<br>PHYSICAL PLANT<br>33RD AND UNIVERSITY AVENUE<br>LITTLE ROCK ARKANSAS<br>72204 | JIM JOYNER<br>(501)569-3390 | HONEYWELL DPS-8 | PERSONNEL RECORDS<br>VACATN AND SICK LV RECDS<br>PAYROLL<br>INVENTORY RECORDS |
| 0380 | UNIVERSITY OF BRITISH COLUMBIA<br>PHYSICAL PLANT<br>MGR PHYSICAL PLANT ADMIN-2210 W. MA<br>VANCOUVER B.COLUMBIA<br>CANADA V6T1W5 | BOB BRAY<br>(604)228-4167 | TYPE NOT DEFINED | PAYROLL<br>PROJECT COST REPORTING<br>KEY RECORDS<br>INVENTORY RECORDS |
| 0032 | UNIVERSITY OF CALIFORNIA<br>FACILITIES MANAGEMENT<br>IRVINE CALIF<br>92717 | ROBERT BEVERIDGE<br>(714)833-5204 | PRIME 500<br>DEC 1140 | PERSONNEL RECORDS<br>VACATN AND SICK LV RECDS<br>PAYROLL<br>PROJECT COST REPORTING<br>KEY RECORDS |
| 0388 | UNIVERSITY OF CALIFORNIA-RIVERSIDE<br>DEPT OF PHYSICAL PLANT<br>UNIV OF CALIFORNIA<br>RIVERSIDE CALIF<br>92521 | SAL MARTINO<br>(714)787-4218 | IBM 4341<br>DEC PDP-11 | PERSONNEL RECORDS<br>VACATN AND SICK LV RECDS<br>PAYROLL<br>PREVENTIVE MAINT SCHED<br>PROJECT SCHEDULING<br>PROJECT ESTIMATING<br>PROJECT COST REPORTING<br>PROJECT BILLING<br>EQUIPMENT RECORDS<br>PURCHASE ORDERS |
| 0095 | UNIVERSITY OF CALIFORNIA-SAN DIEGO<br>PHYSICAL PLANT OPERATIONS Q-032<br>LA JOLLA CALIF<br>92093 | DAVID N. EDWARDS<br>(619)452-2341 | BURROUGHS 7805 | PERSONNEL RECORDS<br>VACATN AND SICK LV RECDS<br>PAYROLL<br>PREVENTIVE MAINT SCHED<br>PROJECT SCHEDULING<br>PROJECT ESTIMATING<br>PROJECT COST REPORTING<br>PROJECT BILLING<br>EQUIPMENT RECORDS<br>PURCHASE ORDERS<br>INVENTORY RECORDS |

123

THE ASSOCIATION OF PHYSICAL PLANT ADMINISTRATORS
OF UNIVERSITIES AND COLLEGES (APPA)
COMPUTERIZATION QUESTIONNAIRE RESPONDENT DATA

PREPARED BY E G AND G INTERTECH

MAY 16, 1983 - 11 46 AM

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|---|---|---|---|---|
| 0395 | UNIVERSITY OF CALIFORNIA-SANTA CRUZ<br>OFFICE OF CAMPUS FACILITIES<br>1156 HIGH STREET<br>SANTA CRUZ CALIF<br>95064 | EARL CANTLAY<br>(408)429-2432 | TYPE NOT DEFINED | PAYROLL<br>PROJECT ORDER ISSUE<br>PROJECT COST REPORTING<br>PROJECT BILLING<br>KEY RECORDS<br>PURCHASE ORDERS<br>INVENTORY RECORDS |
| 0359 | UNIVERSITY OF CINCINNATI<br>DEPT OF PHYSICAL PLANT<br>2900 READING ROAD<br>CINCINNATI OHIO<br>45221 | MOHAMMAD QAYOUMI<br>(513)475-5069 | AMDAHL 470<br>WANG | PERSONNEL RECORDS<br>VACATN AND SICK LV RECDS<br>PAYROLL<br>PROJECT COST REPORTING<br>EQUIPMENT RECORDS<br>PURCHASE ORDERS<br>INVENTORY RECORDS |
| 0090 | UNIVERSITY OF COLORADO<br>DEPT OF FACILITIES MANAGEMENT<br>CAMPUS BOX B-53<br>BOULDER COLORADO<br>80309 | JOYCE GOMEZ<br>(303)492-5508 | MICRO-DATA ROYALE | PERSONNEL RECORDS<br>VACATN AND SICK LV RECDS<br>PROJECT SCHEDULING<br>PROJECT ESTIMATING<br>PROJECT ORDER ISSUE<br>PROJECT COST REPORTING<br>PROJECT BILLING |
| 0260 | UNIVERSITY OF DAYTON<br>DEPT OF PHYSICAL PLANT<br>300 COLLEGE PARK AVE<br>DAYTON OHIO<br>45469 | WILLIAM J. RICHESON<br>(513)229-3747 | UNIVAC 90/80 | VACATN AND SICK LV RECDS<br>PAYROLL |
| 0313 | UNIVERSITY OF FLORIDA<br>PHYSICAL PLANT DIVN<br>BLDG 700<br>GAINESVILLE FLORIDA<br>32611 | CRAIG SMITH<br>(904)392-1141 | IBM 3033<br>IBM 4341<br>AMDAHL 470 | PERSONNEL RECORDS<br>PAYROLL<br>PROJECT BILLING<br>PURCHASE ORDERS<br>INVENTORY RECORDS |
| 0398 | UNIVERSITY OF GEORGIA<br>PHYSICAL PLANT DIRECTOR'S OFF<br>CEDAR ST AND E. CAMPUS ROAD<br>ATHENS GEORGIA<br>30602 | W.K. JORDAN<br>(404)542-1141 | IBM 370 158<br>TRS 80 M III | VACATN AND SICK LV RECDS<br>PAYROLL<br>PREVENTIVE MAINT SCHED<br>PROJECT ESTIMATING<br>PROJECT COST REPORTING<br>PROJECT BILLING<br>EQUIPMENT RECORDS<br>PURCHASE ORDERS<br>INVENTORY RECORDS |

THE ASSOCIATION OF PHYSICAL PLANT ADMINISTRATORS
OF UNIVERSITIES AND COLLEGES (APPA)
COMPUTERIZATION QUESTIONNAIRE RESPONDENT DATA

PREPARED BY E G AND G INTERTECH — MAY 16, 1983 - 11 46 AM

| SER NUM | INSTITUTION | CONTACT PERSON | COMPUTER(S) IN USE | FUNCTIONS PERFORMED |
|---|---|---|---|---|
| 0192 | UNIVERSITY OF GUELPH<br>PHYSICAL RESOURCES<br>PHYS RES SERVICES BLDG<br>GUELPH ONTARIO<br>CANADA N1G2W1 | R.R. JENKINS<br>(519)824-4120 | TYPE NOT DEFINED | PERSONNEL RECORDS<br>VACATN AND SICK LV RECDS<br>PAYROLL<br>PROJECT ORDER ISSUE<br>PROJECT COST REPORTING<br>PROJECT BILLING |
| 0035 | UNIVERSITY OF HOUSTON<br>PHYSICAL PLANT<br>4211 ELGIN STREET<br>HOUSTON TEXAS<br>77004 | H.I. COLLIER<br>(713)749-4846 | HONEYWELL DELTA 5600 | PERSONNEL RECORDS<br>VACATN AND SICK LV RECDS<br>PROJECT ESTIMATING<br>PROJECT ORDER ISSUE<br>PROJECT COST REPORTING<br>PROJECT BILLING<br>KEY RECORDS |
| 0069 | UNIVERSITY OF HOUSTON CLEAR LAKE<br>PHYSICAL PLANT<br>2700 BAY AREA BLVD<br>HOUSTON TEXAS<br>77058 | MICHAEL MORAVEK<br>(713)488-9227 | APPLE II | PREVENTIVE MAINT SCHED |
| 0362 | UNIVERSITY OF IDAHO<br>PHYSICAL PLANT<br>MOSCOW IDAHO<br>83843 | KENNETH A. HALL<br>(208)885-6246 | IBM 4341 | PERSONNEL RECORDS<br>VACATN AND SICK LV RECDS<br>PAYROLL<br>PROJECT SCHEDULING<br>PROJECT BILLING<br>INVENTORY RECORDS |
| 0007 | UNIVERSITY OF ILLINOIS<br>OPERATION AND MAINTENANCE DIV<br>1501 S. OAK ST.<br>CHAMPAIGN ILL.<br>61820 | RALPH G. ROSSMAN<br>(217)333-8380 | IBM 3081 | PROJECT SCHEDULING<br>PROJECT ORDER ISSUE<br>PROJECT COST REPORTING<br>PROJECT BILLING |
| 0391 | UNIVERSITY OF IOWA<br>PHYSICAL PLANT OFFICE<br>103 W. BURLINGTON<br>IOWA CITY IOWA<br>52242 | GEORGE KLEIN<br>(319)353-3010 | IBM 370<br>IBM P C | PERSONNEL RECORDS<br>VACATN AND SICK LV RECDS<br>PAYROLL<br>PREVENTIVE MAINT. SCHED<br>PROJECT ORDER ISSUE<br>PROJECT COST REPORTING<br>PROJECT BILLING<br>KEY RECORDS<br>EQUIPMENT RECORDS<br>PURCHASE ORDERS<br>INVENTORY RECORDS |

THE ASSOCIATION OF PHYSICAL PLANT ADMINISTRATORS
OF UNIVERSITIES AND COLLEGES (APPA)
COMPUTERIZATION QUESTIONNAIRE RESPONDENT DATA

PREPARED BY E G AND G INTERTECH — MAY 16, 1983 - 11 46 AM

| SER NUM | INSTITUTION | CONTACT PERSON | COMPUTER(S) IN USE | FUNCTIONS PERFORMED |
|---|---|---|---|---|
| 0252 | UNIVERSITY OF KANSAS<br>FACILITIES OPERATIONS<br><br>LAWRENCE KANSAS<br>66045 | TOM ANDERSON<br>(913)864-4770 | IBM 3031 | PERSONNEL RECORDS<br>PREVENTIVE MAINT SCHED<br>PROJECT ORDER ISSUE<br>PROJECT COST REPORTING<br>EQUIPMENT RECORDS<br>PURCHASE ORDERS |
| 0123 | UNIVERSITY OF KENTUCKY<br>DESIGN CONSTRUCTION AND PHYS PLANT<br>ROOM 225-PETERSON SERVICE BLDG<br>LEXINGTON KENTUCKY<br>40506 | JAMES E. WESSELS<br>(606)257-3404 | | |
| 0394 | UNIVERSITY OF LETHBRIDGE<br>V.P. CAMPUS DEVELOPMENT<br>4401 UNIVERSITY DRIVE<br>LETHBRIDGE ALBERTA<br>CANADA T1K3M4 | R.F. COMSTOCK<br>(403)329-2604 | DEC 20 | EQUIPMENT RECORDS |
| 0013 | UNIVERSITY OF MAINE<br>DEPT OF PHYSICAL PLANT<br>SERVICE BLDG<br>ORONO MAINE<br>04469 | DAVID TREFETHEN<br>(207)581-2676 | IBM UNDEFINED | PERSONNEL RECORDS<br>VACATN AND SICK LV RECDS<br>PAYROLL<br>PROJECT COST REPORTING |
| 0225 | UNIVERSITY OF MAINE AT MACHIAS<br>PHYSICAL PLANT OFFICE<br>O'BRIEN AVE<br>MACHIAS MAINE<br>04654 | DONALD C. CRANDLEMIRE<br>(207)255-3313 | TIME SHARING | PERSONNEL RECORDS<br>PAYROLL<br>EQUIPMENT RECORDS<br>INVENTORY RECORDS |
| 0050 | UNIVERSITY OF MARYLAND<br>DEPT OF PHYSICAL PLANT<br>SOUTH ADMIN BLDG-ROOM 0101<br>COLLEGE PARK MARYLAND<br>20742 | JIM HUPE<br>(301)454-5913 | UNIVAC 1108<br>TIME SHARING | VACATN AND SICK LV RECDS<br>PREVENTIVE MAINT SCHED<br>PURCHASE ORDERS<br>INVENTORY RECORDS |
| 0038 | UNIVERSITY OF MASSACHUSETTS/AMHERST<br>PHYSICAL PLANT DEPT<br>CAMPUS CENTER WAY<br>AMHERST MASS<br>01003 | MRS. BERTILLE DROZDAL<br>(413)545-0600 | NAT ADV SYST AS6000 | PERSONNEL RECORDS<br>VACATN AND SICK LV RECDS<br>PAYROLL<br>PROJECT ESTIMATING<br>PROJECT ORDER ISSUE<br>PROJECT COST REPORTING<br>PROJECT BILLING<br>EQUIPMENT RECORDS<br>PURCHASE ORDERS<br>INVENTORY RECORDS |

THE ASSOCIATION OF PHYSICAL PLANT ADMINISTRATORS
OF UNIVERSITIES AND COLLEGES (APPA)
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|---|---|---|---|---|
| 0242 | UNIVERSITY OF MIAMI<br>PHYSICAL PLANT<br>1535 LEVANTE AVE<br>CORAL GABLES FLORIDA<br>33124 | | TYPE NOT DEFINED | VACATN AND SICK LV RECDS<br>PAYROLL |
| 0375 | UNIVERSITY OF MINNESOTA<br>PHYSICAL PLANT OPERATIONS<br>319 15TH AVE S.E.-200 SHOPS<br>MINNEAPOLIS MINNESOTA<br>55455 | W.E. SOUERBERG<br>(612)373-4521 | IBM 3033<br>CDC CYBER | PAYROLL<br>PROJECT SCHEDULING<br>PROJECT COST REPORTING |
| 0377 | UNIVERSITY OF MONTANA<br>PHYSICAL PLANT DEPT<br>BUILDING 32<br>MISSOULA MONTANA<br>59812 | FRANK S. SHANDORF<br>(406)243-6111 | TYPE NOT DEFINED | PERSONNEL RECORDS<br>VACATN AND SICK LV RECDS<br>PAYROLL<br>PROJECT COST REPORTING<br>PROJECT BILLING<br>EQUIPMENT RECORDS |
| 0036 | UNIVERSITY OF N C ASHVILLE<br>MAINT AND OPERATION-PHYSICAL PLANT<br>P.O. BOX 8467<br>ASHEVILLE N.C.<br>28814 | SAMUEL J. MILLAR<br>(704)258-6564 | PDISE PDP 11-34 | VACATN AND SICK LV RECDS<br>PAYROLL<br>EQUIPMENT RECORDS |
| 0044 | UNIVERSITY OF N C CHAPELHILL<br>PHYSICAL PLANT DEPT<br>AIRPORT ROAD--168A<br>CHAPEL HILL N.C.<br>27514 | MS. FAYE HOWERTON<br>(919)966-5471 | UNIVAC 90/80 | PERSONNEL RECORDS<br>VACATN AND SICK LV RECDS<br>PAYROLL<br>PREVENTIVE MAINT SCHED<br>PROJECT ORDER ISSUE<br>PROJECT COST REPORTING<br>PROJECT BILLING<br>EQUIPMENT RECORDS<br>PURCHASE ORDERS<br>INVENTORY RECORDS |
| 0067 | UNIVERSITY OF N C CHARLOTTESVILLE<br>PHYSICAL PLANT<br>UNCC STATION<br>CHARLOTTE N.C.<br>28223 | C.G. RUST<br>(704)597-2605 | BURROUGHS 9600 | PERSONNEL RECORDS<br>VACATN AND SICK LV RECDS<br>PAYROLL<br>PURCHASE ORDERS |

THE ASSOCIATION OF PHYSICAL PLANT ADMINISTRATORS
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|---|---|---|---|---|
| 0045 | UNIVERSITY OF NEBRASKA AT OMAHA<br>PLANT MANAGEMENT<br>60TH AND DODGE STREETS<br>OMAHA NEBRASKA<br>68182 | NICK COMBS<br>(402)554-2672 | DEC 1134 | PREVENTIVE MAINT SCHED<br>INVENTORY RECORDS |
| 0198 | UNIVERSITY OF NEW HAMPSHIRE<br>DIRECTOR-BLDGS AND GRNDS<br>FACYS SERVICE BLDG<br>DURHAM NEW HAMPSHIRE<br>03824 | H.H. DOZIER JR.<br>(603)862-2656 | DEC 10 | PERSONNEL RECORDS<br>VACATN AND SICK LV RECDS<br>PAYROLL<br>PROJECT COST REPORTING<br>PROJECT BILLING |
| 0023 | UNIVERSITY OF NEW MEXICO<br>PHYSICAL PLANT<br>ALBUQUERQUE NEW MEXICO<br>87131 | BILL VAN VLACK<br>(505)277-2464 | | |
| 0177 | UNIVERSITY OF NEW ORLEANS<br>PHYSICAL PLANT SERVICES<br>LAKEFRONT<br>NEW ORLEANS LOUISIANA<br>70148 | RICHARD H. CARLSTROM<br>(504)286-6587 | IBM 4331 | PERSONNEL RECORDS<br>PAYROLL<br>INVENTORY RECORDS |
| 0146 | UNIVERSITY OF NORTH DAKOTA<br>PLANT SERVICES<br>UNIVERSITY STATION<br>GRAND FORKS N.DAKOTA<br>58202 | LEROY SONDROL<br>(701)777-2591 | TYPE NOT DEFINED | PROJECT COST REPORTING<br>PROJECT BILLING<br>KEY RECORDS<br>PURCHASE ORDERS<br>INVENTORY RECORDS |
| 0366 | UNIVERSITY OF NORTHERN COLORADO<br>DEPT OF FACILITIES AND OPERATIONS<br>411 20TH STREET<br>GREELEY COLORADO<br>80639 | JULIE SWANSON<br>(303)351-2446 | IBM 148 | PAYROLL<br>PROJECT ORDER ISSUE<br>PROJECT COST REPORTING<br>PROJECT BILLING<br>PURCHASE ORDERS |
| 0011 | UNIVERSITY OF NORTHERN IOWA<br>PLANT SERVICE DEPT<br>23RD AND COLLEGE<br>CEDAR FALLS IOWA<br>50614 | D. STONER<br>(319)273-6293 | MCL POWERS 600 | PREVENTIVE MAINT SCHED |

THE ASSOCIATION OF PHYSICAL PLANT ADMINISTRATORS
OF UNIVERSITIES AND COLLEGES (APPA)
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|---|---|---|---|---|
| 0105 | UNIVERSITY OF NOTRE DAME<br>PHYSICAL PLANT<br>NOTRE DAME INDIANA<br>46556 | DON DEDRICK<br>(219)239-7391 | TIME SHARING | PREVENTIVE MAINT SCHED |
| 0310 | UNIVERSITY OF PITTSBURGH<br>PHYSICAL PLANT DIVN<br>B-80 BENEDUM HALL<br>PITTSBURGH PENNA<br>15261 | A. VAN CONKLIN<br>(412)624-5689 | MAGNUSON 80 | PERSONNEL RECORDS<br>PAYROLL<br>PROJECT COST REPORTING<br>PROJECT BILLING |
| 0314 | UNIVERSITY OF QUEENSLAND<br>BLDGS AND GRNDS BRANCH<br>ST. LUCIA<br>BRISBANE QUEENSLAND<br>AUSTRALIA 4067 | CHARLES MCCOWIE<br>(07)377-3000 | TYPE NOT DEFINED | PERSONNEL RECORDS<br>PAYROLL<br>PROJECT ORDER ISSUE<br>PROJECT COST REPORTING<br>PROJECT BILLING<br>EQUIPMENT RECORDS<br>PURCHASE ORDERS |
| 0155 | UNIVERSITY OF SOUTH DAKOTA<br>PHYSICAL PLANT<br>VERMILLION S.DAKOTA<br>57064 | LUANN OVELLETTE<br>(605)677-5341 | IBM 3031 | PREVENTIVE MAINT SCHED<br>PROJECT ORDER ISSUE |
| 0224 | UNIVERSITY OF TENNESSEE<br>PHYSICAL PLANT DEPT<br>2233 VOLUNTEER BOULEVARD<br>KNOXVILLE TENN<br>37996 | MIKE SHERRELL<br>(615)974-2414 | ALTOS 80600 | PERSONNEL RECORDS |
| 0347 | UNIVERSITY OF TEXAS AT AUSTIN<br>PLANT MGMT AND GEN SERVICES<br>UNIVERSITY STATION-P.O. DRAWER 7580<br>AUSTIN TEXAS<br>78712 | H.C. LOTT JR.<br>(512)471-4110 | IBM 3081 | PERSONNEL RECORDS<br>VACATN AND SICK LV RECDS<br>PAYROLL<br>PREVENTIVE MAINT SCHED<br>PROJECT SCHEDULING<br>PROJECT ESTIMATING<br>PROJECT ORDER ISSUE<br>PROJECT COST REPORTING<br>PROJECT BILLING<br>EQUIPMENT RECORDS<br>PURCHASE ORDERS<br>INVENTORY RECORDS |

THE ASSOCIATION OF PHYSICAL PLANT ADMINISTRATORS
OF UNIVERSITIES AND COLLEGES (APPA)
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|---|---|---|---|---|
| 0327 | UNIVERSITY OF TEXAS AT TYLER<br>PHYSICAL PLANT DEPT<br>3900 UNIVERSITY BLVD<br>TYLER TEXAS<br>75701 | L.J. GRUBBS/STEVE WILSON<br>(214)566-1471 | AAMDAHL V7A | PERSONNEL RECORDS<br>PAYROLL<br>EQUIPMENT RECORDS<br>INVENTORY RECORDS |
| 0199 | UNIVERSITY OF TEXAS-EL PASO<br>PHYSICAL PLANT<br>PHYSICAL PLANT<br>EL PASO TEXAS<br>79968 | JIM GRAY<br>(915)747-5516 | IBM 4341 | INVENTORY RECORDS |
| 0108 | UNIVERSITY OF TOLEDO<br>PHYSICAL PLANT<br>2801 W. BANCROFT ST<br>TOLEDO OHIO<br>43606 | RICHARD B. VANLANDINGHAM<br>(419)537-4161 | MCL POWERS 570 | PREVENTIVE MAINT SCHED |
| 0116 | UNIVERSITY OF UTAH<br>PLANT OPERATNS-CENTRAL SERVICES DPT<br>222 UNIVERSITY SERVICES BLDG-UNIV O<br>SALT LAKE CITY UTAH<br>84112 | PETER VAN DER HAVE<br>(801)581-5082 | MICRO-DATA 6000 | PERSONNEL RECORDS<br>PREVENTIVE MAINT SCHED<br>PROJECT SCHEDULING<br>PROJECT COST REPORTING<br>PROJECT BILLING<br>KEY RECORDS<br>EQUIPMENT RECORDS |
| 0141 | UNIVERSITY OF VERMONT<br>PHYSICAL PLANT DEPT<br>622 MAIN STREET<br>BURLINGTON VERMONT<br>05405 | WILBUR E. NEWTON<br>(802)656-2186 | TRS 80 M III | PREVENTIVE MAINT SCHED<br>PROJECT SCHEDULING<br>PROJECT COST REPORTING |
| 0046 | UNIVERSITY OF VIRGINIA<br>DEPT OF PHYSICAL PLANT<br>575 ALDERMAN ROAD<br>CHARLOTTESVILLEVIRGINIA<br>22903 | JAMES T. MERGNER<br>(804)924-6934 | IBM 4341 | PERSONNEL RECORDS<br>VACATN AND SICK LV RECDS<br>PAYROLL<br>PREVENTIVE MAINT SCHED<br>PROJECT COST REPORTING<br>PROJECT BILLING |

THE ASSOCIATION OF PHYSICAL PLANT ADMINISTRATORS
OF UNIVERSITIES AND COLLEGES (APPA)
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|---|---|---|---|---|
| 0335 | UNIVERSITY OF WASHINGTON<br>PHYSICAL PLANT DEPT<br><br>SEATTLE WASH<br>98195 | JOHN A. HEINZ<br>(206)545-1419 | DEC 1134<br>IBM 360 | PERSONNEL RECORDS<br>VACATN AND SICK LV RECDS<br>PREVENTIVE MAINT SCHED<br>PROJECT SCHEDULING<br>PROJECT COST REPORTING<br>PROJECT BILLING<br>KEY RECORDS<br>EQUIPMENT RECORDS<br>INVENTORY RECORDS |
| 0040 | UNIVERSITY OF WATERLOO<br>DEPT OF PLANT OPERATIONS<br>200 UNIVERSITY AVE. W.<br>WATERLOO ONTARIO<br>CANADA N2L3G1 | J.W.G. SLOAN<br>(519)885-1211 | IBM 4341 | PERSONNEL RECORDS<br>VACATN AND SICK LV RECDS<br>PAYROLL<br>PREVENTIVE MAINT SCHED<br>KEY RECORDS<br>EQUIPMENT RECORDS<br>INVENTORY RECORDS |
| 0381 | UNIVERSITY OF WESTERN ONTARIO<br>PHYSICAL PLANT DEPT<br>1151 RICHMOND ST-RM 355 STEVENSON-L<br>LONDON ONTARIO<br>CANADA N6A5B8 | R.M. YEO<br>(519)679-2202 | IBM 4341 | PERSONNEL RECORDS<br>VACATN AND SICK LV RECDS<br>PAYROLL<br>PROJECT COST REPORTING<br>EQUIPMENT RECORDS<br>PURCHASE ORDERS<br>INVENTORY RECORDS |
| 0122 | UNIVERSITY OF WISCONSIN-OSHKOSH<br>FACILITIES MANAGEMENT<br>800 ALGOMA BLVD<br>OSHKOSH WISCONSIN<br>54901 | DONALD R. WOLTER<br>(414)424-0220 | IBM 370 | PERSONNEL RECORDS<br>PAYROLL<br>KEY RECORDS<br>EQUIPMENT RECORDS<br>INVENTORY RECORDS |
| 0132 | UNIVERSITY OF WISCONSIN-PARKSIDE<br>PHYSICAL PLANT<br>WOOD ROAD-BOX 2000<br>KENOSHA WISCONSIN<br>53141 | JACK C. DUDLEY<br>(414)553-2334 | TYPE NOT DEFINED | PROJECT COST REPORTING |
| 0147 | UNIVERSITY OF WISCONSIN-SUPERIOR<br>PHYSICAL PLANT DEPT<br>1800 GRAND AVENUE<br>SUPERIOR WISCONSIN<br>54880 | GEORGE R. LANDIS<br>(715)394-8123 | BURROUGHS 1835 | PREVENTIVE MAINT SCHED<br>PROJECT COST REPORTING<br>PROJECT BILLING<br>KEY RECORDS<br>EQUIPMENT RECORDS<br>INVENTORY RECORDS |

THE ASSOCIATION OF PHYSICAL PLANT ADMINISTRATORS
OF UNIVERSITIES AND COLLEGES (APPA)
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MAY 16, 1983 - 11 46 AM

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|---|---|---|---|---|
| 0053 | UNIVERSITY SYSTEM OF NEW HAMPSHIRE<br>PHYS PLANT DEVELOPMT AND UTILITIES<br>DUNLAP CENTER-WEST<br>DURHAM NEW HAMPSHIRE<br>03824 | G.A. RUFFNER<br>(603)868-1800 | IBM DISPLAYWRITER | PROJECT COST REPORTING |
| 0254 | UNIV. OF OKLAHOMA HEALTH SVCS CNTR<br>SITE SUPPORT<br>P.O. BOX 26901<br>OKLAHOMA CITY OKLAHOMA<br>73190 | CHARLES M. YORK<br>(405)271-2121 | | |
| 0113 | URSINUS COLLEGE<br>PHYSICAL PLANT<br>MAIN ST.<br>COLLEGEVILLE PENNA<br>19426 | FREDERICH L. KLEE<br>(215)489-4111 | NORTHSTAR HORIZON | PERSONNEL RECORDS |
| 0148 | UT AT DALLAS<br>PHYSICAL PLANT<br>P.O. BOX 688<br>RICHARDSON TEXAS<br>75080 | RAY SMITH<br>(214)690-2141 | IBM 370-155 | PERSONNEL RECORDS<br>VACATN AND SICK LV RECDS<br>PAYROLL<br>PROJECT BILLING<br>KEY RECORDS<br>EQUIPMENT RECORDS<br>PURCHASE ORDERS |
| 0137 | UTAH STATE UNIVERSITY<br>PHYSICAL PLANT DIVN<br>UMC 66<br>LOGAN UTAH<br>84322 | HYRUM HALL<br>(801)750-1941 | NORTHSTAR HORIZON | PERSONNEL RECORDS<br>VACATN AND SICK LV RECDS<br>PREVENTIVE MAINT SCHED<br>PROJECT SCHEDULING<br>PROJECT COST REPORTING<br>PROJECT BILLING<br>KEY RECORDS<br>EQUIPMENT RECORDS<br>PURCHASE ORDERS<br>INVENTORY RECORDS |
| 0014 | UTAH TECHNICAL COLLEGE-SALT LAKE<br>FACILITIES DIVN<br>P.O. BOX 31808<br>SALT LAKE CITY UTAH<br>84131 | PAUL R. GUNDERSEN<br>(801)967-4111 | TYPE NOT DEFINED | VACATN AND SICK LV RECDS<br>PAYROLL<br>PREVENTIVE MAINT SCHED<br>KEY RECORDS<br>PURCHASE ORDERS<br>INVENTORY RECORDS |

THE ASSOCIATION OF PHYSICAL PLANT ADMINISTRATORS
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|---|---|---|---|---|
| 0126 | U.OF ILL.COL OF MEDICINE AT PEORIA<br>PHYSICAL PLANT<br>1 ILLINI DRIVE-P.O.BOX 1649<br>PEORIA ILLINOIS<br>61656 | HENRY W. RAPP JR.<br>(309)671-3015 | IBM P C | INVENTORY RECORDS |
| 0098 | VALENCIA COMMUNITY COLLEGE<br>FACILITIES<br>P.O. BOX 3028<br>ORLANDO FLORIDA<br>32802 | H. SPENCER GRAVES<br>(305)299-5000 | | PERSONNEL RECORDS<br>VACATN AND SICK LV RECDS<br>PAYROLL<br>INVENTORY RECORDS |
| 0372 | VANDERBILT UNIVERSITY<br>PLANT OPERATIONS<br>BRYAN BLDG<br>NASHVILLE TENN<br>37240 | ANDREE' GLENN<br>(615)322-2622 | HP3000<br>HONEYWELL LEVEL 6/47 | PERSONNEL RECORDS<br>VACATN AND SICK LV RECDS<br>PAYROLL<br>PREVENTIVE MAINT SCHED<br>PURCHASE ORDERS<br>INVENTORY RECORDS |
| 0079 | VANIER COLLEGE<br>DIRECTOR OF ADMIN SERVICES<br>821 STE-CROIX BOULEVARD<br>SAINT-LAURENT QUEBEC<br>CANADA H4L3X9 | ROBIN J. RUGG<br>(514)333-3887 | BURROUGHS UNDEFINED | PERSONNEL RECORDS<br>VACATN AND SICK LV RECDS<br>PAYROLL<br>PROJECT COST REPORTING<br>EQUIPMENT RECORDS |
| 0096 | VIRGINIA POLYTECHNIC INSTITUTE AND<br>PHYSICAL PLANT DEPT<br>331 BURRUSS HALL<br>BLACKSBURG VIRGINIA<br>24061 | GEORGE W. LARSEN<br>(703)961-6291 | IBM 370 158 | PERSONNEL RECORDS<br>PURCHASE ORDERS |
| 0127 | WAKE FOREST UNIVERSITY<br>PHYSICAL PLANT<br>BOX 7286<br>WINSTON-SALEM N.C.<br>27109 | BRUCE VAUGHAN<br>(919)765-5612 | DATAPOINT 1800 | PROJECT COST REPORTING<br>PROJECT BILLING<br>INVENTORY RECORDS |
| 0157 | WASHINGTON AND LEE COLLEGE<br>BLDGS AND GRNDS<br>LEXINGTON VIRGINIA<br>24450 | JAMES ARTHUR<br>(703)463-9111 | TIME SHARING | KEY RECORDS<br>PURCHASE ORDERS |

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|---|---|---|---|---|
| 0351 | WASHINGTON STATE UNIVERSITY<br>PHYSICAL PLANT DEPT<br>MCCLUSKEY SERVICES BLDG<br>PULLMAN WASHINGTON<br>99164 | RICHARD S. JACOBS<br>(509)335-4565 | AAMDAHL V8 | PREVENTIVE MAINT SCHED<br>PROJECT SCHEDULING<br>PROJECT ORDER ISSUE<br>PROJECT COST REPORTING<br>PROJECT BILLING<br>EQUIPMENT RECORDS<br>INVENTORY RECORDS |
| 0103 | WASHINGTON UNIVERSITY<br>PHYSICAL FACILITIES<br>CAMPUS BOX 1036<br>ST. LOUIS MISSOURI<br>63130 | GARY FOREMAN<br>(314)889-5550 | IBM 370 | PAYROLL |
| 0092 | WAYNE STATE UNIVERSITY<br>PHYSICAL PLANT DEPT<br>5454 CASS<br>DETROIT MICH<br>48202 | ERMAN FISHER<br>(313)577-4301 | AMDAHL 470<br>APPLE II | PERSONNEL RECORDS<br>VACATN AND SICK LV RECDS<br>PAYROLL<br>PROJECT ORDER ISSUE<br>PROJECT COST REPORTING<br>PROJECT BILLING |
| 0222 | WENTWORTH INST OF TECHNOLOGY<br>550 HUNTINGTON AVE<br>BOSTON MASS<br>02115 | | TYPE NOT DEFINED | PERSONNEL RECORDS<br>VACATN AND SICK LV RECDS<br>PAYROLL |
| 0112 | WESLEYAN UNIVERSITY<br>PHYSICAL PLANT<br>186 COLLEGE ST<br>MIDDLETOWN CONN<br>06457 | PETER H. TRESKOR<br>(203)347-9411 | TYPE NOT DEFINED | PERSONNEL RECORDS<br>VACATN AND SICK LV RECDS<br>PAYROLL<br>INVENTORY RECORDS |
| 0186 | WEST TEXAS STATE UNIVERSITY<br>DEPT OF PHYSICAL PLANT<br>BOX 805 W.T. STATION<br>CANYON TEXAS<br>79016 | MARVIN L. PATTON<br>(806)656-3831 | DEC 10 | KEY RECORDS |

THE ASSOCIATION OF PHYSICAL PLANT ADMINISTRATORS
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|---|---|---|---|---|
| 0240 | WEST VA. SCH OF OSTEOPATHIC MEDICIN<br>DIR OF PHYSICAL PLANT<br>400 N. LEE ST<br>LEWISBURG WEST VA.<br>24901 | KEN DILLON<br>(304)645-6270 | | |
| 0100 | WESTERN BAPTIST COLLEGE<br>BUSINESS MANAGERS OFFICE<br>5000 DEER PARK DR. S.E.<br>SALEM OREGON<br>97301 | DARRELL PATTERSON<br>(503)581-8600 | TIME SHARING | PAYROLL |
| 0106 | WESTERN ILLINOIS UNIVERSITY<br>PHYSICAL PLANT<br><br>MACOMB ILLINOIS<br>61455 | GEORGE GOEHNER<br>(309)298-1834 | TYPE NOT DEFINED | PERSONNEL RECORDS<br>VACATN AND SICK LV RECDS<br>PAYROLL<br>PROJECT ORDER ISSUE<br>PROJECT COST REPORTING<br>PROJECT BILLING<br>PURCHASE ORDERS |
| 0144 | WHITWORTH COLLEGE<br>PHYSICAL PLANT DEPT<br>W. HAWTHORNE RD<br>SPOKANE WASHINGTON<br>99251 | DON HOLDEN<br>(509)466-3254 | TYPE NOT DEFINED | VACATN AND SICK LV RECDS<br>PAYROLL |
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THE ASSOCIATION OF PHYSICAL PLANT ADMINISTRATORS
OF UNIVERSITIES AND COLLEGES (APPA)
COMPUTERIZATION QUESTIONNAIRE RESPONDENT DATA

PREPARED BY E G AND G INTERTECH

MAY 16, 1983 - 11 46 AM

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Appendix B

# Glossary of Technical Terms

## A

**Analog** — The first computers were analog devices. They measure rather than count and are used today mostly to measure physical variables such as voltages, pressures, and temperatures. A household thermostat is a simple form of analog computer.

**ASCII** — Acronym for American Standard Code for Information Interchange. One of a number of industry standard computer codes for converting alphanumerics and punctuation into binary numbers.

**ANSI** — American National Standards Institute; an agency that develops industry-wide standards. Some success with the computer industry, but difficult due to quickly changing technology.

**Applications programs** — Programs designed to do specific jobs such as preventive maintenance, housekeeping, or safety and security inspections. Usually written by the user or his or her computer consultant, although some widely used programs are available for purchase.

**Architecture** — The way a computer or computer system is designed or built. It can refer to the arrangement of components inside the cabinet or the way a system is hooked up.

**ASSEMBLER** — A programming language mostly for mini- and micro-computers supplied by the computer manufacturer to enable programmers to write machine-oriented programs capable of performing binary-level operations. Limited memory capacity gives ASSEMBLER less flexibility than COBOL or PLI.

**Asynchronous** — Data transmission term meaning that a character must have a signal at the beginning and the end to tell the computer when to start and stop. Messages are not time limited, so each character becomes a complete message. Simple hardware such as teletypes communicate this way.

**Attached resource computer** — System that provides the computer with the power of a big machine and the versatility of small machines.

## B

**BASIC** — Beginners' All-purpose Symbolic Instruction Code. An easy-to-use, high-level language that works best in solving equations, although it is often used in business data processing.

**Batch processing** — When information is saved up and put into the computer for processing at one time. Formerly done exclusively with punched cards, batch-type jobs can now be accomplished with almost any kind of data input terminal.

**Baud** — Measure of speed in data transmission. 500 Baud means 500 bits of data per second can be transmitted. 500 is roughly equivalent to 50 characters per second.

**Belt printer** — A rugged, high-speed printer that uses a rotating belt to transfer characters to paper. Primarily used for mainframe systems.

**Binary** — The base-two number system used by digital computers. It uses combinations of the numbers 1 and 0 to form all numbers and letters.



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**Bit**—A single digit in binary math. It can be either a 1 or a 0.
**BPI**—Bits per inch. The density with which digital data can be packed onto magnetic tape or other recording devices.
**Buffer**—Part of a computer's memory where data can be stored temporarily until the computer is ready to process it. Some peripherals also have buffers.
**Byte**—Eight bits. Memory capacity of a computer is usually given in number of bytes.

# C

**Canned programs**—Commonly used programs that are available for purchase from manufacturers or from other users of the same type of system.
**Central processing unit (CPU)**—Technically, the logic and arithmetic circuitry of a computer where data actually get processed. The CPU is completely electronic and issues commands to all other parts of the system.
**Character**—A single digit, letter, or symbol that a computer can recognize. Ordinarily represented in one-byte combinations of 1 and 0.
**Chip**—A tiny bit of silicon, the size of a fingernail or smaller, some containing as much electronic circuitry as the room-sized computers of the early 1960s. Chips make micro- and mini-computers possible.
**COBOL**—COmmon Business Oriented Language. A programming language that simplifies business data processing programs. Its instructions are similar to ordinary English.
**Code**—Jargon for a computer program. The symbols and characters that have meaning to a computer. Programs are written in code.
**Command**—An instruction in code that tells the computer what to do next.
**Compatibility**—The ability of a computer from one manufacturer to work with different models from the same manufacturer or with computers from other manufacturers. Also, a computer's ability to work with other devices such as printers, data storage units, etc.
**Compiler**—A computer program that translates instructions written in a specific high-level programming language into machine language the computer can understand. If the program is in COBOL, you would need a COBOL Compiler.
**Configuration**—The design or layout of a particular computer or dispersed data processing system with all its peripherals.
**CPS**—Characters per second or cycles per second. One way to express the speed of printers or other equipment that produces text.
**CRT**—Cathode Ray Tube. The output display of a computer terminal that looks like a small television screen.
**Cursor**—Symbol on the video terminal that shows where the next character will be located.

# D

**Daisy Wheel**—A wheel with characters around the rim used on some types of printers to transfer characters to paper. They provide the closest to letter quality or typewriter-quality text of all mechanical printing methods.
**Data**—The information manipulated, produced, and transmitted by the computer.
**Database**—A large collection of files and data stored in a computer's system; can be organized or retrieved by a program.
**Data file**—A file of raw information understood and used by a program.
**Debugging**—Locating and deleting or correcting problems in a program or system.
**Dedicated**—A system designed or built for one function or for one particular department or user.
**Documentation**—Proven evidence of a software program's efficiency and effectiveness.
**Digital**—Computer that uses the binary number system. Nearly all modern computers used in business are digital.

**Disk**—A flat, rotating plate or plates used to record information magnetically. Disks can be rigid (hard) or flexible (floppy).

**Diskette**—Small, flexible disks used to record information magnetically. They have less capacity than hard disks but are much less expensive. Also known as floppy disks.

**Dispersed data processing**—Computer system made up of a number of small, inexpensive computers. Each has its own information storage devices and other peripherals so that some work can be performed independently of other computers in the network. Yet all the computers can provide information to some central point. If the computers are geographically dispersed, they are linked by telecommunications. A network might also be set up to disperse data processing functions throughout a large campus. Each building would have its own small system. The network approach has proven to be a much more convenient, economical approach than having one big, centralized computer.

**Dot matrix**—A fast, inexpensive printing method that forms characters through a series of closely spaced dots that strike a sheet of paper through an inked ribbon.

**Downtime**—The time during which computer equipment is not working.

**Drum**—Cylinder-shaped device for magnetically recording information.

## E

**Emulator**—A program that allows a computer from one manufacturer to communicate with a computer from a different manufacturer or to simulate its instructions.

## F

**File**—A collection of information relating to the same subject stored in a specific place in a computer system's disk or tape storage.

**Floppy disk**—**See Diskette.**

**FORTRAN**—FORmula TRANslation. Programming language used mostly for complicated mathematical problems in science and engineering.

**Furniture**—The cabinetry that houses the electronics of a computer or data processing devices

## H

**Hardware**—The physical components of a computer system, including all its mechanical, electronic, electrical, and magnetic parts.

**High-level languages**—Programming languages that use English words and commands. The closer to English the higher the level, and higher level languages make programming easier. COBOL, FORTRAN, BASIC, and others are high-level languages.

**Host computer**—The main computer on which a number of terminals or smaller computers are connected.

## I

**I/O**—Input/Output. Equipment used to enter and retrieve information. The computer's sensory and communications organs.

**Integrated electronic office**—A business office where most standard office functions are carried out electronically by computers, word processing machines, magnetic file storage devices, automatic call distributors, electronic mail devices, and so on. Frequently referred to as the "office of the future" since some of the necessary electronic devices are yet to be put on the market. Be careful here—integration is the big problem. All the devices must be compatible in order to work together.

**Interactive** — A computer or program that is able to conduct a textual conversation with its operator. The computer prompts the operator, helps him or her through a routine, checks input information for accuracy, and notifies the operator when a mistake is made.

**Interface** — A device or a point that brings together hardware, software, and the human operator or programmer.

**Interpreter** — A program that translates high-level languages into something the computer can understand.

**Interprocessor bus** — A coaxial cable connecting the processors and peripherals in a bus-based computer system.

# K

**K** — 1K is equal to 1,024 and is used in defining storage capacity.

# L

**Language** — The numbers, characters, punctuation, and symbols used to write instructions for a computer.

**Letter quality** — Printing method in which a mechanical element strikes the paper with an inked ribbon to produce an image.

**Line printer** — A printer that prints a full line at a time. Gives very high speeds, but the printing quality is generally not as good as that of character printers.

**Local network** — A group of minicomputers integrated into a single system. The minicomputers are interconnected with coaxial cable or other wideband communications media and typically share printing and disk file resources.

**LPM** — Lines per minute. Another way to express how fast a printer prints.

# M

**Machine language** — The lowest level computer language, and the most precise. Too cumbersome for writing programs, so you need a compiler or interpreter to translate high-level programs into machine language. Every manufacturer has a different one.

**Mainframe** — An extremely large capacity, complex computer system based on one central processor.

**Megabytes** — A million bytes. More accurately, 1,048,576 units of information.

**Memory** — Device or section of the computer where data can be stored and retrieved. The size of a computer is defined in terms of memory. The larger the memory capacity, the larger and more complex the computer programs can be.

**Menu** — List of files, libraries, or programs within a computer's system.

**Microcomputer** — Small-capacity system that can perform logical and arithmetic functions.

**Microprocessor** — An extremely small unit with its processing circuitry on a single chip.

**Minicomputer** — Relatively small, inexpensive computer designed to perform business data processing tasks. They can do almost anything a mainframe computer can do and, in some cases, do it better.

**MIPS** — Millions of instructions per second. A measure of how fast a computer can work that takes a variety of physical factors into account.

**Modem** — MOdulator/DEModulator. A telecommunications device that makes it possible for a computer to send digital information over telephone lines.

**Multifunction** — The capability of a single workstation, minicomputer, or terminal to perform a variety of different tasks. For example, a multifunction workstation is one which is able to perform data processing, word processing, and electronic message transfer functions as needed.

**Multiprocessing** — The practice of using a number of processors — each dedicated to a different system task such as file management, communications, or applications processing — to expand memory use and increase throughput.

**Multiprogramming** — The procedure of dividing a computer's memory into "partitions" to run more than one program at the same time. For example, preventive maintenance, housekeeping, and safety and security programs can be run on the same computer at the same time.

**Multitasking or multiuse capability** — When a single program is capable of operating several tasks that are related in some way.

# N

**Nanosecond** — One billionth of a second. Computers typically work at speeds measured in nanoseconds.

**Network** — A group of computers interconnected by telephone or telegraph lines for communications.

# O

**OEM** — Original equipment manufacturer. Any company that manufactures hardware used in data processing — from the small company with only a few products, to the full-line, full-service manufacturer.

**Off-line** — Data processing that is not done by a computer, such as the clerical work required to prepare information for processing. Can also mean that the computer or some other part of the system is out of order or simply not connected to the system.

**On-line** — Any data processing work under the direct control of the computer. Can also mean that a component of the system is in operation.

**Overhead** — The amount of a computer's memory required to organize the operation of a computer system. Important because the more overhead required, the less memory there is left in the computer to execute applications programs.

# P

**Peripheral** — Any device in a data processing system, other than a computer, necessary for storage, entry, or retrieval of data. Examples are printers, tape drives, modems, CRTs, etc.

**PLI** — Programming Language I. Common language used with modern mainframe computers. Capable of numerous complex functions on large groups of data.

**Plug compatible** — Two devices that can be made to work together without needing any special interface equipment.

**Processor** — Technically, the computer's arithmetic and logic circuitry and memory access and their associated parts. The part that actually does the calculations and manipulations comprising data processing.

**Program** — A series of instructions telling a computer how to solve a specific problem or perform a specific job.

# R

**RAM** — Random access memory. Items stored can be retrieved as needed regardless of their location in storage.

**Response time** — The time it takes for an action to be completed. Generally, the interval between executing a command or inquiry at a terminal and receiving the answer at the same terminal.

**ROM** — Read only memory. Nonerasable system instructions that are built into the computer. Usually used to tell the computer how to accomplish routine tasks.

**RPG** — Report program generator. A programming language used most often to produce information in a certain format.

# S

**Security** — Methods used to prevent unauthorized access to part or all of the information in a database. An important consideration in systems where the database is shared by several users.

**Semiconductor** — Any material whose electrical conductivity is somewhere between that of an insulator and a conductor and whose conductivity varies with temperature. The hotter they are, the better conductors they are. Silicon is a semiconductor. They make up many of the electronic components in computers and are much more reliable than the vacuum tubes they replaced. Also referred to as solid-state circuitry.

**Sequential access** — When information stored in a computer's memory must be retrieved in the order in which it was stored.

**Shared logic** — The ability of a single computer to share its processing capability among multiple users, permitting each to perform different tasks simultaneously.

**Shared resources** — The power of a sophisticated operating system that lets each user specify at sign-on time the files and peripherals he or she needs to accomplish the processing task.

**Simulator** — A program that simulates the operation of another computer. An easy way of tricking computers into being compatible.

**Software** — The programs that make the computer perform specific functions.

**Stand-alone** — A computer that can work independently of other computers.

**Storage** — Any device in a computer system capable of retaining information.

**Support** — Engineering help provided by the manufacturer in fitting the system to the customer's requirements, getting it installed, and keeping it running.

**Synchronous** — In data transmission, a system in which messages are sent from one device to another within a specified length of time. Receiver and transmitter must be synchronized in order to communicate. Most efficient when large volumes of data must be transferred.

**Systems house** — Usually describes an independent, third-party firm that sells computer systems acquired from one or more manufacturers.

**Systems software** — The package of programs that organizes the memory of a computer system. The most fundamental component is known as the operating system. Usually furnished by the manufacturer.

# T

**Telecommunications** — Information sent and received over telephone lines.

**Terminal** — Any device used to put information into, or remove information from, a computer. A keyboard and screen that provides a human interface.

**Throughput** — The amount of work that a computer can accomplish in a given amount of time.

**Throughput speed** — The speed with which a computer converts input to output.

**Time sharing** — When two or more users work on the same computer at the same time but at separate terminals.

**Turnkey system** — A product or system that is ready to use when purchased.

# U

**Upgrade** — Substituting a larger computer for a smaller one to accommodate the growth of a physical plant or its increasing needs for data processing.

**User friendly** — Describes a system or program whose instructions are easily understood by a computer novice.

**Utility program** — A system software program that helps programmers and operators perform specific types of common jobs. A program that sorts names and addresses is a common utility.

# V

# W

**Vendor** — Anyone who sells computer hardware or software — from the full-line computer manufacturer to the store that sells ribbons for the printers. Suppliers, in other words.

**Winchester disk** — A popular hard disk system for smaller computers.

# About the Authors

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